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(54) [TITLE OF THE INVENTION] MOBILE COMMUNICATION SYSTEM

(57) [ABSTRACT]

[Task] To improve equipment efficiency by doing away with the need for retaining surplus equipment by making each base station able to change its transmission output in response to changes in the volume of traffic.

[Means] The volume of traffic of each base station is collected in cycles by a center station 3 from the CPU 18 of each base station. If the center station 3 discovers from the traffic volume collected from each base station, for example, the base station CS2 in which the traffic has exceeded a threshold value, the center station 3 outputs a command to increase transmission output to, for example, the base station CS1 whose traffic volume is at the minimum from among those base stations surrounding the base station CS2. The CPU 18 of the base station CS1 that receives this command decreases the attenuation level of an attenuator 16 and increases the output level of the transmission signals so as to increase the size of the service area thereof and thus increase the size of its service area that overlaps with the service area of the base station CS2. If the base station CS1 takes charge of a portion of the communication of mobile terminals within the service area of the base station CS2, the traffic of the base station CS2 is lowered to below the threshold level and the communication of the mobile terminal can always be performed smoothly.

[CLAIMS]

[Claim 1]

A mobile communication system comprising:

a mobile terminal for transmitting and receiving information;

a plurality of base stations for relaying communication mutually between the mobile terminals or with a public line network; and

a center station for controlling each of the base stations connected to the public line network, wherein

each of the base stations is equipped with:

a transmission output circuit that is capable of changing a transmission output level; and

an output control means for controlling the size of a transmission signal level output from the transmission output circuit using commands from the center station, and

the center station is equipped with traffic control means for outputting a command to change a transmission output via the public line network to the output control means of the base station.

[Claim 2]

The mobile communication system according to claim 1, wherein each time the output control means of the base station receives a command output from the traffic control means of the center station to change the transmission output, it changes a transmission output level that is output from the transmission

output circuit each time by a predetermined level.

[Claim 3]

The mobile communication system according to claim 1, wherein information on the level of the change in output is contained in the transmission output change command output from the traffic control means of the center station; and the output control means of the base station changes the level of the transmission output that is output from the transmission output circuit to a level that matches this output change level information.

[Claim 4]

The mobile communication system according to claim 1, wherein: each base station is provided with data reporting means for measuring current traffic volumes within its own service area and transmitting this to the center station via the public line network; and the center station is provided with data collection means for receiving traffic volumes transmitted from the data reporting means of each base station and collecting it for each base station, and wherein the traffic control means of the center station issues the transmission output change command based on the traffic volumes collected for each base station by the data collection means.

[Claim 5]

The mobile communication system according to claim 3, wherein the reporting means of the base station transmits the traffic volume to the center station at the time the reporting means receives a data transmission request from the data

collection means of the center station.

[Claim 6]

The mobile communication system according to claim 4, wherein, based on traffic volumes for each base station collected by the data collection means, the traffic control means searches for base stations whose traffic volume has exceeded a threshold value and, if such as base station is discovered, issues the transmission output increase command, which is a version of the transmission output change command, to base stations peripheral to the relevant base station.

[Claim 7]

The mobile communication system according to claim 6, wherein, based on the traffic volumes of each base station collected by the data collection means, the traffic control means searches for the base station having the smallest traffic volume from among the peripheral base stations and issues the transmission output increase command to this base station.

[Claim 8]

The mobile communication system according to claim 6, wherein, based on the traffic volumes of each base station collected by the data collection means, the traffic control means searches for the base station having the smallest traffic volume from among the peripheral base stations and issues the transmission output increase command to this base station, and if, as a result of which, the traffic volume of the base station whose traffic volume first exceeded the threshold value does not drop below the threshold value, the traffic control means

issues the transmission output increase command to the base station having the second smallest traffic volume from among the peripheral base stations and, thereafter, the traffic control means sequentially issues the transmission output increase command to the base stations in sequence starting from that base station that has the smallest traffic volume from among the peripheral base stations and continues until the traffic volume of the base station whose traffic volume first exceeded the threshold value drops below the threshold value.

[Claim 9]

The mobile communication system according to claim 8, wherein, if the transmission output of the base station receiving the transmission output increase command is at maximum, the traffic control means issues the transmission output increase command to the next base station.

[Claim 10]

The mobile communication system according to any of claims 6 to 9, wherein, based on traffic volumes for each base station collected by the data collection means, the traffic control means determines the size of the traffic volume of the base station whose traffic volume first exceeded the threshold value and the size of the traffic volume of the base station having an increased transmission output, and based on these sizes issues a transmission output decrease command, which is a version of the transmission output change command, to the base station having the increased transmission output.

[Claim 11]

The mobile communication system according to any of claims 6 to 9, wherein, based on traffic volumes for each base station collected by the data collection means, the traffic control means determines the average of the traffic volume of the base station whose traffic volume first exceeded the threshold value and the traffic volume of the base station having an increased transmission output, and if this average is below a predetermined value, issues a transmission output decrease command, which is a version of the transmission output change command, to the base station having the increased transmission output.

[Claim 12]

The mobile communication system according to any of claims 6 to 9, wherein, based on traffic volumes for each base station collected by the data collection means, the traffic control means determines the traffic volume of the base station whose traffic volume first exceeded the threshold value and the traffic volume of the base station having an increased transmission output, and based on a result obtained by performing a variety of statistical processings on these traffic volumes, issues a transmission output decrease command, which is a version of the transmission output change command, to the base station having the increased transmission output.

[Claim 13]

The mobile communication system according to claim 10, wherein, based on traffic volumes for each base station collected by the data collection means, the traffic control

means issues the transmission output decrease command to the base station having the smallest traffic volume from among the base stations that have increased their transmission output and if, as a result of which, the average of the traffic volumes does not drop below the predetermined value, the traffic control means issues the transmission output decrease command to the base station having the second smallest traffic volume from among the base stations that have increased their transmission output and, thereafter, the traffic control means sequentially issues the transmission output decrease command to the base stations in a sequence starting from that base station that has the smallest traffic volume from among the base stations that have increased their transmission output and continues until the average of the traffic volumes drops below the threshold value.

[Claim 14]

The mobile communication system according to claim 13, wherein, if the transmission output of the base station receiving the transmission output decrease command is at minimum, the traffic control means issues the transmission output decrease command to the next base station.

[Claim 15]

The mobile communication system according to claim 1, wherein each base station is provided with a plurality of receiving systems and a reception synthesizing section for synthesizing signals received by the receiving systems, and wherein synthesized received signals from the reception

synthesizing section are taken as final received signals.

[Claim 16]

The mobile communication system according to claim 15, wherein each receiving system comprises an antenna and a receiving section, and an antenna of one receiving system doubles as an antenna for transmitting.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical Field]

The present invention relates to a mobile communication system for carrying out the communication of a mobile terminal such as a portable telephone via a base station, and particularly, to a structure that enables the transmission output of a base station to be changed.

[0002]

[Related Art]

Conventionally, in a mobile communication system, the size of the service areas S of the respective base stations CS1 to CS7 has been fixed in the manner shown in Fig. 12, for example. Accordingly, in a service area S in which it is predicted that the volume of traffic will be large, the number of radio lines is increased so as to respond to the volume of traffic predicted. However, this response has been by arranging the base stations more densely.

[0003]

However, because the volume of traffic changes depending on the location and also changes over time, it is difficult to

predict in advance the manner in which the traffic volume will change. Accordingly, if the traffic volume changes abruptly, the available radio channels that need to be allocated for the communication run out resulting in some cases in communication not being possible. Accordingly, because it is necessary to set the installation number and locations of the base stations with enough leeway that they can deal with the traffic volume even when this increases substantially, the installation and operating expenses build up creating a deterioration in the equipment efficiency, particularly when there is an excess of unused equipment at times when the traffic volume is light. As a result, it has been difficult to construct a communication system that has good efficiency.

[0004]

[Problem to be Solved by the Invention]

In order to respond to changes in the traffic volume over time in a conventional mobile communication system such as that described above, because it is necessary to set the installation number and locations of the base stations with enough leeway that they can deal with the traffic volume even when this increases substantially, the installation and operating expenses build up creating a deterioration in the equipment efficiency, particularly when there is an excess of unused equipment at times when the traffic volume is light. As a result, it has been difficult to construct a communication system that has good efficiency.

[0005]

Therefore, the present invention has been made in order to solve problems such as those described above, and it is an aim thereof to provide a mobile communication system that enables rapid changes in the traffic volume to be dealt with, and that does away with the need to provide surplus equipment thus increasing the equipment efficiency.

[0006]

[Means for Solving the Problem]

The first aspect of the present invention is a mobile communication system comprising: a mobile terminal for transmitting and receiving information; a plurality of base stations for relaying communication mutually between the mobile terminals or with a public line network; and a center station for controlling each of the base stations connected to the public line network, wherein each of the base stations is equipped with: a transmission output circuit that is capable of changing a transmission output level; and an output control means for controlling the size of a transmission signal level output from the transmission output circuit using commands from the center station, and the center station is equipped with traffic control means for outputting a command to change a transmission output via the public line network to the output control means of the base station.

[0007]

The second aspect of the present invention is structured such that each time the output control means of the base station receives a command output from the traffic control means of the

center station to change the transmission output, it changes a transmission output level that is output from the transmission output circuit each time by a predetermined level.

[0008]

The third aspect of the present invention is structured such that information on the level of the change in output is contained in the transmission output change command output from the traffic control means of the center station; and the output control means of the base station changes the level of the transmission output that is output from the transmission output circuit to a level that matches this output change level information.

[0009]

The fourth aspect of the present invention is structured such that: each base station is provided with data reporting means for measuring current traffic volumes within its own service area and transmitting this to the center station via the public line network; and the center station is provided with data collection means for receiving traffic volumes transmitted from the data reporting means of each base station and collecting it for each base station, and wherein the traffic control means of the center station issues the transmission output change command based on the traffic volumes collected for each base station by the data collection means.

[0010]

The fifth aspect of the present invention is structured such that the reporting means of the base station transmits the

traffic volume to the center station at the time the reporting means receives a data transmission request from the data collection means of the center station.

[0011]

The sixth aspect of the present invention is structured such that, based on traffic volumes for each base station collected by the data collection means, the traffic control means searches for base stations whose traffic volume has exceeded a threshold value and, if such as base station is discovered, issues the transmission output increase command, which is a version of the transmission output change command, to base stations peripheral to the relevant base station.

[0012]

The seventh aspect of the present invention is structured such that, based on the traffic volumes of each base station collected by the data collection means, the traffic control means searches for the base station having the smallest traffic volume from among the peripheral base stations and issues the transmission output increase command to this base station.

[0013]

The eighth aspect of the present invention is structured such that, based on the traffic volumes of each base station collected by the data collection means, the traffic control means searches for the base station having the smallest traffic volume from among the peripheral base stations and issues the transmission output increase command to this base station, and if, as a result of which, the traffic volume of the base station

whose traffic volume first exceeded the threshold value does not drop below the threshold value, the traffic control means issues the transmission output increase command to the base station having the second smallest traffic volume from among the peripheral base stations and, thereafter, the traffic control means sequentially issues the transmission output increase command to the base stations in sequence starting from that base station that has the smallest traffic volume from among the peripheral base stations and continues until the traffic volume of the base station whose traffic volume first exceeded the threshold value drops below the threshold value.

[0014]

The ninth aspect of the present invention is structured such that, if the transmission output of the base station receiving the transmission output increase command is at maximum, the traffic control means issues the transmission output increase command to the next base station.

[0015]

The tenth aspect of the present invention is structured such that, based on traffic volumes for each base station collected by the data collection means, the traffic control means determines the size of the traffic volume of the base station whose traffic volume first exceeded the threshold value and the size of the traffic volume of the base station having an increased transmission output, and based on these sizes issues a transmission output decrease command, which is a version of the transmission output change command, to the base

station having the increased transmission output.

[0016]

The eleventh aspect of the present invention is structured such that, based on traffic volumes for each base station collected by the data collection means, the traffic control means determines the average of the traffic volume of the base station whose traffic volume first exceeded the threshold value and the traffic volume of the base station having an increased transmission output, and if this average is below a predetermined value, issues a transmission output decrease command, which is a version of the transmission output change command, to the base station having the increased transmission output.

[0017]

The twelfth aspect of the present invention is structured such that, based on traffic volumes for each base station collected by the data collection means, the traffic control means determines the traffic volume of the base station whose traffic volume first exceeded the threshold value and the traffic volume of the base station having an increased transmission output, and based on a result obtained by performing a variety of statistical processings on these traffic volumes, issues a transmission output decrease command, which is a version of the transmission output change command, to the base station having the increased transmission output.

[0018]

The thirteenth aspect of the present invention is

structured such that, based on traffic volumes for each base station collected by the data collection means, the traffic control means issues the transmission output decrease command to the base station having the smallest traffic volume from among the base stations that have increased their transmission output and if, as a result of which, the average of the traffic volumes does not drop below the predetermined value, the traffic control means issues the transmission output decrease command to the base station having the second smallest traffic volume from among the base stations that have increased their transmission output and, thereafter, the traffic control means sequentially issues the transmission output decrease command to the base stations in a sequence starting from that base station that has the smallest traffic volume from among the base stations that have increased their transmission output and continues until the average of the traffic volumes drops below the threshold value.

[0019]

The fourteenth aspect of the present invention is structured such that, if the transmission output of the base station receiving the transmission output decrease command is at minimum, the traffic control means issues the transmission output decrease command to the next base station.

[0020]

The fifteenth aspect of the present invention is structured such that each base station is provided with a plurality of receiving systems and a reception synthesizing

section for synthesizing signals received by the receiving systems, and wherein synthesized received signals from the reception synthesizing section are taken as final received signals.

[0021]

The sixteenth aspect of the present invention is structured such that each receiving system comprises an antenna and a receiving section, and an antenna of one receiving system doubles as an antenna for transmitting.

[0022]

[Embodiments of the Invention]

A description will now be given of the embodiments of the present invention with reference made to the drawings. Fig. 1 shows the structure of the first embodiment of the mobile communication system of the present invention and is a block diagram (CS1, SC2, CS3···) showing the present invention applied to a simple portable telephone system (i.e. PHS). The symbol 1 indicates a base station that is connected to an ISDN public line network 2 and that carries out communication by setting radio lines with mobile terminals 4a to 4f that are located within the area of the base station; 2 is an ISDN public line network; 3 is a center station that is connected to the ISDN public line network 2 and that performs various controls for the mobile communication system such as controlling and setting the transmission output and various operations of the base station 1 and is formed, for example, from a work station and a communication interface section that connects this work

station to the ISDN public line network 2. 4a to 4f are mobile terminals such as portable telephones. Note that the base stations CS2 and CS3 have the same structure as the base station CS1.

[0023]

Here, in order for the base station 1 to be able to reliably receive transmission signals from mobile stations using the space diversity method, it is provided with: antennas 19a to 19d that are each installed a predetermined distance from each other; a high frequency switch section11 either for switching the signals received by the antennas 19a to 19d to receiving sections 12a to 12d or for switching signals input from a high frequency power amplifying section used for transmission to the antennas 19a to 19d; receiving sections 12a to 12d for receiving transmission signals from mobile terminals 4a to 4f that have been picked up by the antennas 19a to 19d; a reception synthesizing section 13 for synthesizing the reception signals of the receiving sections 12a to 12d; a line interface section 14 that connects the ISDN public line network 2 with the host base station; a transmission section 15 that outputs carrier high frequency signals that have been modulated by signals from the line interface section 14; an attenuator 16 that adjusts the level of the carrier high frequency signals output from the transmission section 15; a high frequency power amplification section 17 for amplifying the power of the carrier high frequency signals input from the attenuator 16; and a CPU 18 for adjusting the attenuation levels of the attenuator 16 or

performing various controls for all of the base stations such as processing to ascertain the traffic volume of the host base station and inform the center station of this.

[0024]

Fig. 2 is a block diagram showing detailed example of the structure of the above described base station. The receiving sections 12a to 12d are provided with a receiving circuit 121 for receiving transmission signals from portable telephones and a demodulating circuit 122 for demodulating received signals of the receiving circuit 121. In addition, between the reception synthesizing section 13 and the line interface 14 is provided a TDMA decoding section 20. Demodulated signals that have been synthesized by the reception synthesizing section 13 and undergone time division multiplexing using the TDMA format are separated by the TDMA decoding section 20 into signals for each slot, then are output to the ISDN public line network via the line interface section 14. Furthermore, between the line interface section 14 and the transmission section 15 is provided a TDMA encoding section 21. The plurality of signals input from the line interface section 14 are encoded using time division multiplexing by the TDMA encoding section 21 and output to the transmission section 15. The transmission section 15 is provided with a modulating circuit 151 for modulating signals that have undergone TDMA encoding and a transmission circuit 152 for changing modulated signals modulated by the modulating circuit 151 into transmission signals.

[0025]

Fig. 3 is a block diagram showing a detailed example of the structure of the center station 3 shown in Fig. 1. The symbol 21 indicates a CPU for performing various processing such as controlling the host center station and controlling the transmission outputs of the base stations; 32 indicates RAM for storing data of various types necessary for the operation of the CPU; 33 indicates ROM for storing programs and the like that control the CPU 31; 34 indicates a keyboard for the inputting of various types of commands by an operator; 35 indicates a CRT for displaying the information; and 36 indicates a communication interface for performing the transmission and reception of information of various types with the ISDN public line network 2. Note that the CPU 31, the RAM 32, the ROM 33, the keyboard 44, the CRT 35, and the like may form part of a workstation or the like.

[0026]

Fig. 4 is a view showing the placing of each of the base stations having the structure described in Figs. 1 and 2 and the range of the service areas S in the charge of each of the base stations during normal times. In this example, seven base stations CS1 to CS7 are arranged as in the drawing to form the vertexes of a hexagon and the center point thereof. Each service area S of the base stations CS1 to CS7 extends in a circular shape centering on the respective base station and is arranged such that portions of each service area S overlap with other service areas S. The mobile terminals in each of the seven service areas S is able to communicate by establishing a radio

line to the base station in whose service area the mobile terminal is currently located.

[0027]

The operation of the present embodiment will now be described. The center station 3 performs traffic data collection processing in accordance with a flow chart such as is shown in Fig. 5 at a set cycle in order to ascertain the traffic volumes of each base station (i.e. CS1, CS2, CS3, etc). Here the traffic volume that is to be the subject of the data collection processing may be the data of the number of lines that are in use at the time of the data collection processing, or may be a time meter due to the fact that lines being will have been used since the time of the previous data collection. Namely, in step 501, the CPU 31 of the center station 3 transmits a command to send traffic data to the relevant base station via the ISDN public line network 2. When it receives this command the CPU 18 of the relevant base station sends the current traffic volume in its own base station from the line interface section 14 to the center station 3 via the ISDN public line network 2. Note that various formats may be used for the procedure of sending and receiving the traffic data between the center station and the base station. For example, it is also possible for the sending of the command from the center station not to be performed and for each base station to automatically send the traffic data after predetermined time intervals.

[0028]

As a result, in step 502, the CPU 31 of the center station

3 receives the traffic volume that is sent from the base station and stores the obtained traffic volume in a control table such as that shown in Fig. 6 that is set up in the RAM 32. Thereafter, in step 504, the CPU 31 determines whether or not traffic volumes have been collected from all of the base stations CS1 to CS7. If they have not all been collected, the routine returns to step 501 and the above processing is performed for the next base station. If traffic volumes have been collected from all the base stations CS1 to CS7, the routine is ended.

[0029]

Fig. 6 shows a data table in which are collected the traffic volumes of the base stations CS1 to CS7 that have been collected in the center station 3 as described above. The current traffic volumes of each base station CS1 to CS7 are stored in a list. These traffic volumes are updated each time the center station 3 performs the processing shown in Fig. 5.

[0030]

It should be noted that the transmission outputs of the respective base stations CS1 to CS7 forming the mobile communication system are such that the service areas S of each base station CS1 to CS7 are as is shown in Fig. 4. However, as is shown in Fig. 10, the location H of a high volume of traffic in the mobile communication system moves and changes over time, however, the traffic volume of the base station in which it located at any particular time increases and it becomes difficult to place a call within the service area of that base station. In the present example, in order beforehand to avoid

this state of affairs, the traffic volume of a base station whose traffic volume has increased is reduced by the center station 3 and transmission output increase processing is performed by the peripheral base stations so that mobile communication can always be performed smoothly. This processing will now be described in accordance with the flow chart shown in Fig. 7.

[0031]

In step 701, the CPU 31 of the center station 3 searches the data table shown in Fig. 6 to discover whether or not the traffic volume has exceeded the threshold value in any base station. If there is such a base station, the routine moves to step 702. In step 702, the CPU 31 searches the data table for that base station peripheral to the base station that has exceeded the threshold value whose traffic volume is the lightest, and determines to increase the transmission output of this base station. In step 703, a transmission output increase command is then made to this base station via the ISDN public line network 2.

[0032]

Here, if the base station that has exceeded the threshold value is the base station CS1 shown in Fig. 8 and the base station peripheral thereto whose traffic volume is the lightest is the base station CS3 in Fig. 8, the center station 3 issues the above described transmission output increase command to the base station CS3.

[0033]

When the CPU18 of the base station CS3 that is to receive

the transmission output increase command receives the command from the interface section 14, it reduces the attenuation level of the attenuator 16 in accordance with increase level information contained in the increase command, thereby increasing the level of the carrier high frequency signal input into the high frequency power amplification section 17 and increasing the output of the waves transmitted from the antenna 19d. As a result, the service area S of the base station CS3 is increased by the volume that the transmission output was increased and the extent thereof that overlaps with the service area S of the base station CS1 is increased. That portion of the communication that was being relayed by the base station CS1 that corresponds to the above increase in the service area S can now be handled by the base station CS3 resulting it being possible to reduce the traffic volume of the base station CS1.

[0034]

Next, in step 704, the CPU 31 rechecks the data table shown in Fig. 6 and determines whether or not the traffic volume of the base station CS1, whose traffic volume had been found to be in excess of the threshold value in the search conducted in step 701, has now dropped below the threshold value. If it has dropped below the threshold value, the routine is ended. If it has not dropped below the threshold value, the routine moves to step 705 where it is determined whether or not the transmission output of the base station CS3, which is currently operating at increased transmission output, is at maximum. If it is not at maximum, the routine returns to step 703 and

processing to further increase the transmission output of the base station CS3 is performed.

[0035]

In step 703, if it is determined that the transmission output of the base station CS3 is at maximum, the routine moves to step 706 where it is determined whether or not there is any other base station whose transmission output could be increased other than the base station CS3 whose transmission output has already been increased. If there is such a base station, the routine returns to step 702 where once again the data table shown in Fig. 6 is checked where a search is made for the base station whose traffic volume is the lightest from among the remaining base stations whose transmission output is capable of being increased. This base station is then determined to be the base station whose transmission output is to be increased next and the routine moves on to the processing of step 703 and thereafter. However, if in step 706 there is found no base station whose transmission output is able to be increased, the routine is ended.

[0036]

Here, if the base station whose traffic has exceeded the threshold value is the base station CS1 as is described above and the base station whose transmission output has been increased is the base station CS3 in Fig. 8, then if the traffic of the base station CS1 drops below the threshold value at the point when the transmission output of the base station CS3 is increased, the service areas S of the base stations CS1 to CS7

take on the configurations shown in Fig. 8 and the service area S of the base station CS3 overlaps the entire service area S of the base station CS1. The base station CS3 then performs the relaying of the communication of the sizeable number of mobile terminals within the service area S of the base station CS1 and it is possible for the traffic volume of the base station CS1 to be reduced. Naturally, the traffic volume of the base station CS3 increases by the same volume as the traffic volume of the base station CS1 decreases.

[0037]

Next, a description will be given of the receiving operation of the base stations (i.e. CS1, CS2, CS3, etc) shown in Fig. 1. The signals that are sent back and forth between the base stations and the mobile terminals temporally undergo four channel time division multiplexing using the TDAMA-TDD format. Moreover, the transmission signals and the received signals also undergo time division multiplexing. The high frequency switch 11 is switched by the CPU 18 during transmission to the high frequency power amplification section 17 side and connects the output side of the high frequency power amplification section 17 with, for example, the antenna 19d. Transmission signals from this antenna 19d are then emitted as radio waves. At this time, the attenuation level of the attenuator 16 is controlled by the CPU 18; the level of the transmission signals input into the high frequency power amplification section 17 from the transmission section 15 is adjusted; and the transmission output from the high frequency

power amplification section 17 is controlled allowing the ranges of the service areas S of the base stations (CS1, CS2, CS3, etc) to be changed after this. It should be noted that the transmission power output from the high frequency power amplification section 17 is set to be at the normal output level when the attenuation level of the attenuator 16 is at the maximum.

[0038]

During receiving, the high frequency switch 11 is switched by the CPU 18 to the side of the receiving sections 12a, 12b, 12c, and 12d. For example, the receiving section 12a is connected to the antenna 19a, the receiving section 12b is connected to the antenna 19b, the receiving section 12c is connected to the antenna 19c, and the receiving section 12d is connected to the antenna 19d. Accordingly, the receiving sections 12a, 12b, 12c, and 12d receive the identical signals that the antennas 19a, 19b, 19c, and 19d have picked up that were transmitted from the mobile terminals 4a to 4f and these are demodulated. The signals resulting from the demodulating are then synthesized into a single signal by the reception synthesizing section 13 and are output by the line interface section 14. Here, as a result of the same radio waves being received and the received signals being synthesized by the reception synthesizing section 13 using the four system receiving system formed from the antennas 19a, 19b, 19c, and 19d and the receiving sections 12a, 12b, 12c, and 12d, it is possible to improve the directionality of the antennas 19a, 19b,

19c, and 19d and the S/N of the of the received signals. As a result, when the transmission output is increased and the service area S enlarged, it is possible to receive signals of a sufficient quality from far off mobile terminals and keep the quality of the communication above a constant standard when the serviced areas S have been enlarged.

[0039]

Fig. 9 is another specific example showing the ranges of the service areas S of the base stations CS1 to CS7 that result when the transmission output increasing processing of the peripheral base stations shown in Fig. 7 has been performed. In this example, the base station whose traffic has exceeded the threshold value is the base station CS1 and the transmission outputs of the base stations CS2 to CS7 that surround this base station are increased to the maximum output in sequence starting from the base station having the lightest volume of traffic. The service area S of the base station CS1 is thus overlapped with the service areas S of all of the base stations CS2 to CS7 that are peripheral thereto, thereby decreasing the traffic volume of the base station CS1.

[0040]

Here, returning now to Fig. 1, a description will be given of the operation of the base station whose transmission output is being increased. When the CPU 18 receives a transmission output increase command from the center station 3 via the line interface section 14, it controls the attenuator 16 so as to reduce the attenuation level thereof by an volume that

corresponds to the change in the output level of the contained in the above command. It also increases the level of the carrier wave high frequency signals input into the high frequency power amplification section 17 from the transmission section 15 and increases the output of the transmission signals transmitted from the antenna 19d. This kind of control is performed each time the CPU 18 receives a transmission output increase command from the center station 3, and is performed ultimately until the attenuation level of the attenuator 16 reaches zero. At this stage, the transmission output of this base station is at the maximum.

[0041]

Note that the transmission output at the time the attenuation level of the attenuator 16 is at maximum is called the normal output and the service areas S of each of the base stations in this case are as is shown in Fig. 4. Alternatively, unlike the above, it is also possible for the resistance value of the attenuator 16 to be changed by a predetermined level so as to reduce the attenuation level thereof each time the CPU 18 receives a transmission output increase command from the center station 3.

[0042]

Next, if the traffic volume decreases after the center station 3 has increased the transmission output of the base station, it is necessary to perform processing to return to the normal output the transmission outputs of the base stations whose transmission outputs had been increased. This

processing will now be described following the flow chart shown in Fig. 11.

[0043]

In step 111, the CPU 31 of the center station 3 determines from the data table shown in Fig. 6 the average value of the base station (CS1 in the above specific example) whose traffic volume first exceeds the threshold value and the traffic volume of the base station (CS3 in the specific example in Fig. 8) whose transmission output has been increased. The CPU 31 then determines whether or not this average value has dropped below a predetermined value. If it is below the predetermined value, the routine moves to step 112. In step 112, the CPU 31 searches the data table for the base station whose traffic volume is the lightest among the base stations whose transmission outputs were increased. After it has decided to decrease the transmission output of this base station, in step 113, it issues a transmission output decrease command to this base station via the ISDN public line network 2.

[0044]

When the CPU 18 of the base station whose transmission output is to be decreased receives this command from the line interface section 14, by increasing the level of the change to the attenuation level of the attenuator 16 instructed in the command, the level of the carrier high frequency signal input into the high frequency power amplification section 17 is reduced thereby decreasing the output of the radio waves transmitted from the antenna 19d.

[0045]

Here, firstly, if the base station whose traffic volume exceeds the threshold value is CS1 shown in Fig. 8 and the base station whose transmission output is to be decreased is CS3 in Fig. 8, the center station 3 issues the above described transmission output decrease command to the base station CS3. As a result, the service area S of the base station CS3 is made smaller by the volume that the transmission output has been decreased and the range that overlaps with the service area of the base station CS1 is also made smaller. The number of communications that are relayed by the base station CS3 also drops by this volume resulting in the traffic volume of the base station CS1 increasing. However, in this case, because the traffic volumes of the base stations CS1 and CS2 are already reduced at this point, there is no communication logjam even if the traffic volume of the base station CS1 increases.

[0046]

Next, in step 114, the CPU 31 rechecks the data table shown in Fig. 6 and determines whether or not the average value of the traffic volume of the base stations searched out in step 111 is over the predetermined value. If it is over the predetermined value, the processing is ended. If it is not over, the routine moves to step 115 where it is determined whether or not the transmission output of the base station whose transmission output has been decreased is at the minimum (i.e. normal output). If it is not at the minimum, the routine returns to step 113 where processing is performed to reduce the

transmission output of this base station even further.

[0047]

In step 115, if it is determined that the transmission output of the base station is at the minimum, the routine moves to step 116 where, firstly, it is determined whether or not any other base station exists whose transmission output is still in an increased state. If such a base station does exist, the routine returns to step 112 where the data table shown in Fig. 6 is checked once again and a search is made for the base station whose traffic volume is the smallest from among those base stations whose transmission output is still able to be decreased. This base station is then fixed as the next base station to have it transmission output decreased and the routine moves to the processing of step 113 and after. If, however, no base station whose transmission output can be decreased is found in step 116, the routine is ended.

[0048]

Note that, unlike the above description, it is also possible for the resistance value of the attenuator 16 to be changed by a predetermined level so as to increase the attenuation level thereof each time the CPU 18 receives a transmission output decrease command from the center station 3. Alternatively, it is also possible for the CPU 31 of the center station 3 to determine from the data table shown in Fig. 6 the size of the traffic volume of the base station whose traffic volume first exceeded the threshold value (CS1 in the above specific example) and the size of the traffic volume of the base

station (CS3 in the specific example in Fig. 8) whose transmission output was increased as a reference for entering into the processing to decrease the transmission power and to use this size as a basis, or to perform various statistical processing on the traffic volume of the base station whose traffic volume first exceeded the threshold value (CS1 in the above specific example) and the traffic volume of the base station (CS3 in the specific example in Fig. 8) whose transmission output was increased and to use those results as a basis.

[0049]

Here, as is shown in Fig. 8, for example, if the transmission outputs of the base stations CS2 to CS7 are increased so that the service areas S thereof are enlarged, as the traffic volume of the base station CS1 decreases and returns to the normal value, the transmission outputs of the base stations CS2 to CS7 return in sequence to their normal values, so that ultimately they return to the normal state shown in Fig. S.

[0050]

According to the present invention, in order to prevent congestion in the communication of mobile terminals in a base station whose traffic volume has changed, and particularly, has increased, if, by increasing the transmission output of peripheral base stations and covering the service area S of the base station whose traffic volume has increased by overlapping it with the service areas S of the peripheral base stations,

a portion of the communication of the mobile terminals within the service area S of the base station whose traffic volume has increased is shared with the peripheral base stations, then it is possible to decrease the traffic volume of the base station whose traffic volume has increased and perform the communication of the mobile terminal in a smooth fashion.

[0051]

Moreover, when the traffic volume of a single base station is increased by changes in the traffic volume, then by raising the transmission output of the peripheral base stations and increasing the traffic volumes of these base stations so as to level out the traffic volumes of the base stations, the rate of operation and the like of each base station is leveled out resulting in a state of high levels of traffic being able to be dealt with. Therefore, there is no need to provide equipment such as extra base stations and the like which allows the installation costs and operating costs of the equipment to be kept under control enabling an efficient system to be constructed.

[0052]

Furthermore, if the traffic volume is decreased, the transmission outputs of the base stations whose transmission output had been increased can be rapidly restored to their original normal values and the service areas S thereof can be restored to their normal size. Therefore, interference between base stations can be kept to the minimum. Moreover, in the present example, because the receiving system of the base

stations is provided with four systems including antennas, when a transmission output is increased and a service area S enlarged, it is possible to receive high quality signals from far off mobile terminals with good S/N. Therefore, it is possible to maintain an excellent quality of communication through base stations that have had their service area S enlarged by having their transmission output increased as described above. Note that the description of the embodiments given above describes an example of a simple portable telephone system in which each base station is connected via a public line to a center station, however, naturally, the present invention can also be applied to a general portable telephone system in which each base station is connected to a center station via a dedicated line.

[0053]

[Effects of the Invention]

As has been described above, according to the mobile communication system described in any of the first to third aspects, by making the transmission output of each base station able to change to correspond to changes in the volume of traffic so that the range of the service area changes, it is possible to respond dynamically to increases in the traffic volume.

[0054]

According to the mobile communication system described in the fourth or fifth aspects, it is possible to collect the traffic volume of each base station in the center station and for the center station to change the transmission output of each base station based on this collected data.

[0055]

According to the mobile communication system described in the sixth or seventh aspects, it is possible to perform control to decrease the traffic volume of base stations whose traffic volume has increased so that mobile terminal communication can always be performed smoothly.

[0056]

According to the mobile communication system described in the eighth or ninth aspects, by increasing the transmission outputs of a plurality of base stations and decreasing the traffic volume of a base station whose traffic volume has increased, it is possible for mobile terminal communication can always be performed smoothly and for the efficiency of the equipment to be improved by doing away with the need to have extra equipment.

[0057]

According to the mobile communication system described in the tenth through fourteenth aspects, when the traffic volume decreases, the transmission output of a base station whose transmission output had been increased can be rapidly decreased so that interference between base stations can be kept to the minimum.

[0058]

According to the mobile communication system described in the fifteenth and sixteenth aspects, it is possible to maintain an excellent quality of communication even when the service areas increase.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 is a block diagram showing the structure of an embodiment of the mobile communication system of the present invention.

Fig. 2 is a block diagram showing a detailed example of a base station shown in Fig. 1.

Fig. 3 is a block diagram showing a detailed example of a base station shown in Fig. 1.

Fig. 4 is a view showing the layout of the base stations of the mobile communication system shown in Fig. 1 and the range of the service areas thereof.

Fig. 5 is a flowchart showing the processing by the center station shown in Fig. 1 to collect traffic volumes of each base station.

Fig. 6 is a view showing an example of a data table set in the RAM shown in Fig. 3.

Fig. 7 is a flowchart showing the processing to increase the transmission output of a base station by the center station shown in Fig. 1.

Fig. 8 is a view showing the state when the transmission output of one base station of the mobile communication system shown in Fig. 1 is increased and the range of the service area thereof enlarged.

Fig. 9 is a view showing the state when a plurality of transmission outputs of the mobile communication system shown in Fig. 1 are increased and the range of the service areas thereof enlarged.

Fig. 10 is a view showing the state when there is movement by the increased portion of the traffic volume in the mobile communication system shown in Fig. 1.

Fig. 11 is a flowchart showing the processing to decrease the transmission output of a base station by the center station shown in Fig. 1.

Fig. 12 is a view showing the layout of the base stations of a conventional mobile communication system and the range of the service areas thereof.

[Description of the Reference Numerals]

1 (CS1 to CS7) ... Base station

2 ... ISDN public line network

3 ... Center station

11 ... High frequency switch

12a to 12d ... Receiving sections

13 ... Reception synthesizing section

14 ... Line interface section

15 ... Transmission section

16 ... Attenuator

17 ... High frequency power amplification section

18, 31 ... CPU

19a to 19d ... Antennas

32 ... RAM

33 ... ROM

34 ... Keyboard

35 ... CRT

36 ... Communication interface

FIGURES

FIG. 1

2 ISDN PUBLIC LINE CIRCUIT

3 CENTER STATION

14 LINE INTERFACE

13 RECEPTION SYNTHESIZING SECTION

1 BASE STATION (CS1)

19A ANTENNA

12A RECEIVING SECTION RECEIVING SECTION RECEIVING SECTION RECEIVING SECTION

11 HIGH FREQUENCY SWITCH

17 HIGH FREQUENCY POWER AMPLIFICATION SECTION

16 ATTENUATOR

15 TRANSMISSION SECTION

4A MOBILE TERMINAL

1 BASE STATION (CS2)

1 BASE STATION (CS3)

FIG. 2

2 ISDN PUBLIC LINE NETWORK

14 LINE INTERFACE SECTION

20 TDMA DECODING SECTION

21 TDMA ENCODING SECTION

13 RECEPTION SYNTHESIZING SECTION

12A RECEIVING SECTION

121 RECEIVING CIRCUIT

122 DEMODULATING CIRCUIT

11 HIGH FREQUENCY SWITCH

17 HIGH FREQUENCY POWER AMPLIFICATION SECTION

16 ATTENUATOR

15 TRANSMISSION SECTION

152 TRANSMISSION CIRCUIT

151 MODULATING CIRCUIT

FIG. 3

2 ISDN PUBLIC LINE NETWORK

3 CENTER STATION

36 COMMUNICATION INTERFACE

34 KEYBOARD

FIG. 4

SERVICE AREA

FIG. 5

START

501 MAKE ENQUIRY TO BASE STATION

502 RECEIVE REPLY INFORMATION FROM BASE STATION

503 COLLECT TRAFFIC DATA FROM BASE STATION

504 HAS DATA BEEN COLLECTED FROM ALL BASE STATIONS?

END

FIG. 6

BASE STATION

TRAFFIC VOLUME

FIG. 7

START

701 ARE THERE ANY BASE STATIONS WHOSE TRAFFIC VOLUME HAS EXCEEDED THRESHOLD VALUE?

702 SELECT BASE STATION WHOSE TRANSMISSION OUTPUT IS TO BE INCREASED.

703 ISSUE TRANSMISSION OUTPUT INCREASE COMMAND TO RELEVANT BASE STATION

704 IS TRAFFIC VOLUME BELOW THRESHOLD VALUE?

705 IS TRANSMISSION OUTPUT AT MAXIMUM?

706 HAS TRANSMISSION OUTPUT BEEN INCREASED FOR ALL CONTROLLABLE BASE STATIONS?

END

FIG. 11

START

701 ARE THERE ANY BASE STATIONS WHOSE TRAFFIC VOLUME HAS EXCEEDED THRESHOLD VALUE?

702 SELECT BASE STATION WHOSE TRANSMISSION OUTPUT IS TO BE INCREASED.

703 ISSUE TRANSMISSION OUTPUT INCREASE COMMAND TO RELEVANT BASE STATION

704 IS TRAFFIC VOLUME BELOW THRESHOLD VALUE?

705 IS TRANSMISSION OUTPUT AT MAXIMUM?

706 HAS TRANSMISSION OUTPUT BEEN INCREASED FOR ALL CONTROLLABLE BASE STATIONS?

END

FIG. 12

SERVICE AREA

PATENT ABSTRACTS OF JAPAN

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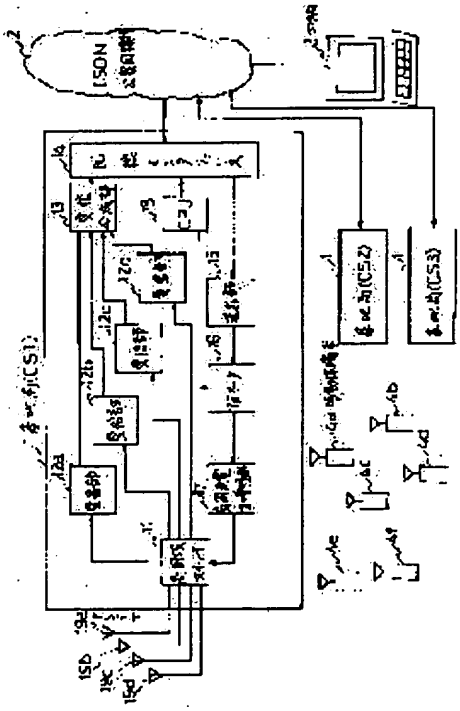
(72)Inventor : NAKAYAMA SATORU

(54) MOBILE OBJECT COMMUNICATION SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To improve the efficiency of facilities by eliminating necessity to provide excessive facilities by varying the transmission output of each base station corresponding to the change of traffic quantity.

SOLUTION: A center station 3 cyclically collects the traffic amounts of respective base stations from CPU 18 of respective base stations. When the center station 3 finds out any base station such as CS 2, for example, whose traffic exceeds a threshold, from the collected traffic amounts of respective base stations, a transmission output increasing instruction is outputted to a base station CS 1, for example, for which the traffic amount is least among the base stations around this base station CS 2. The CPU 18 of base station CS 1, that receives this instruction, decreases the attenuation level of attenuator 16, expands its service area by increasing the output level of transmission signal and widens the area overlapped with the service area of base station CS 2 and the base station CS 1 takes charges of one part of communication of mobile object terminal in the service area of base station CS 2. Thus, the traffic of base station CS 2 is reduced less than the threshold and the communication of mobile object terminal is smoothly performed at all times.



LEGAL STATUS

[Date of request for examination]

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[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] the mobile terminal which transmits and receives information, and between these mobile terminals -- or In the mobile communication system which has two or more base stations from which the communication link with a public line network is relayed, and the pin center,large station which is connected to said public line network and controls said each base station While providing an output-control means to control the magnitude of the sending-signal level outputted to said each base station from the transmitting output circuit which can change a transmitting output level, and this transmitting output circuit by the command from said pin center,large station Mobile communication system characterized by providing the traffic control means which takes out a transmitting output adjustable command to said pin center,large station through said public line network at the output-control means of said base station.
[Claim 2] The output-control means of said base station is mobile communication system according to claim 1 characterized by changing the transmitting output level outputted from the level [every] transmitting output circuit beforehand decided whenever it received the transmitting output possible command outputted from said traffic control means of said pin center,large station.
[Claim 3] The output-control means of said base station is mobile communication system according to claim 1 characterized by changing the transmitting output level outputted to the level include output change level information in the transmitting output adjustable command outputted from said traffic control means of said pin center,large station, and corresponding to said output change level information from said transmitting output circuit.
[Claim 4] While forming a data report means to measure the current amount of traffic in the service area of a local station, and to transmit this to said pin center,large station through said public line network in said each base station A data collection means to receive the amount of traffic transmitted from said data report means of each base station, and to collect for every base station is formed in said pin center,large office. The traffic control means of said pin center,large office is mobile communication system according to claim 1 characterized by said data collection means issuing said transmitting output adjustable command based on the amount of traffic for every base station for collecting.
[Claim 5] The report means of said base station is mobile communication system according to claim 3 characterized by transmitting said amount of traffic to said pin center,large station when the transmitting request of data is received from said data collection means of said pin center,large station.
[Claim 6] Said traffic control means is mobile communication system according to claim 4 characterized by taking out said transmitting output increase command which is a kind of said transmitting output adjustable command to the circumference base station of this base station, when the base station where the amount of traffic exceeded the threshold is looked for and the corresponding base station finds it based on the amount of traffic for every base station which said data collection means collected.
[Claim 7] Said traffic control means is mobile communication system according to claim 6 characterized by looking for the base station where the amount of traffic is the smallest in said circumference base station, and taking out said transmitting output increase command to the base station of relevance based

on the amount of traffic for every base station which said data collection means collected.
[Claim 8] Said traffic control means is based on the amount of traffic for every base station which said data collection means collected. Look for the base station where the amount of traffic is the smallest in said circumference base station, and said transmitting output increase command is taken out to the base station of relevance. When the amount of traffic of said base station where the amount of traffic still exceeded the threshold at the beginning does not become below a threshold, said transmitting increase command is taken out to the base station where the amount of traffic is [2nd] the smallest in said circumference base station. Henceforth, mobile communication system according to claim 6 characterized by taking out said transmitting output increase command to these base stations one by one at the sequence that the amount of traffic is small in said circumference base station until the amount of traffic of said base station where the amount of traffic exceeded the threshold at the beginning becomes below a threshold.
[Claim 9] Said traffic control means is mobile communication system according to claim 8 characterized by taking out said transmitting output increase command to the next base station, when the transmitting output of the base station from which said transmitting output increase command is taken out becomes max.
[Claim 10] the claim 6 which carries out [that said traffic control means takes out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which it asked / base station / for the magnitude of the amount of the base station which increased the amount of traffic and the transmitting output of said base station whose amount of traffic exceeded a threshold at the beginning of traffic based on the amount of traffic for every base station which said data-collection means collected, and increased a transmitting output with this magnitude, and] as the description thru/or 9 -- mobile communication system given in either.
[Claim 11] Said traffic control means is based on the amount of traffic for every base station which said data collection means collected. If it asks for the average of the amount of traffic of the base station which increased the amount of traffic and transmitting output of said base station whose amount of traffic exceeded the threshold at the beginning and this average becomes below a predetermined value claim 6 characterized by taking out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which increased the transmitting output thru/or 9 -- mobile communication system given in either.
[Claim 12] Said traffic control means is based on the amount of traffic for every base station which said data collection means collected. The amount of traffic of the base station which increased the amount of traffic and transmitting output of said base station whose amount of traffic exceeded the threshold at the beginning is calculated. claim 6 characterized by taking out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which increased the transmitting output by the result of having performed and obtained various statistics processings in the amount of these traffic thru/or 9 -- mobile communication system given in either.
[Claim 13] Said traffic control means is based on the amount of traffic for every base station which said data collection means collected. Said transmitting output reduction command is taken out to the base station where the amount of traffic is the smallest in the base station which increased said transmitting output. Said transmitting output reduction command is taken out to the base station where the amount of traffic is [2nd] the smallest in the base station which increased said transmitting output when the average of said amount of traffic still did not become below a predetermined value. Henceforth, mobile communication system according to claim 10 characterized by taking out said transmitting output reduction command to these base stations one by one at the sequence that the amount of traffic is small in the base station which increased said transmitting output until the average of said amount of traffic becomes below a predetermined value.
[Claim 14] Said traffic control means is mobile communication system according to claim 13 characterized by taking out said transmitting output reduction command to the next base station, when the transmitting output of the base station from which said transmitting output reduction command is taken out becomes min.

[Claim 15] Mobile communication system according to claim 1 characterized by equipping said base station with the reception composition section which compounds the input signal by two or more receiving systems and these receiving systems, and making the synthetic input signal of this reception composition section into a final input signal.
[Claim 16] Said each receiving system is mobile communication system according to claim 15 characterized by consisting of an antenna and a receive section and using the antenna of one receiving system also [antenna / for transmission].

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the configuration which carries out adjustable [of especially the transmitting output of a base station] with respect to the mobile communication system which performs the communication link of mobile terminals, such as a portable telephone, through a base station.
[0002]
[Description of the Prior Art] In mobile communication system, the magnitude of the service area S of each base stations CS1-CS7 is being fixed like drawing 12 from the former. Therefore, in the service area S where it is assumed that there are many amounts of traffic, although the number of wireless circuits was increased so that it could respond to the amount of traffic of extent assumed, it corresponded by arranging a base station densely.
[0003] However, since the amount of traffic changes every moment while changing with locations, it is difficult to expect beforehand how the amount of traffic changes. Therefore, it the amount of traffic changed rapidly, the radio channel of the opening which should be assigned to a message is lost and a message becomes impossible. therefore, since hurt **** 7 and installation and employment expense increase, a facility became superfluous when especially the amount of traffic is small and facility effectiveness got worse if an installation, number, etc. of base stations are not set up with allowances so that it can respond, even if said amount of traffic becomes quite large, it was difficult to build efficient communication system.
[0004]
[Problem(s) to be Solved by the Invention] since the above conventional mobile communication system hurts **** 7 if an installation, number, etc. of base stations are not set up with allowances so that it can respond, even if said amount of traffic becomes quite large since it corresponds to the amount of traffic which changes every moment, installation and employment expense increase, a facility became superfluous when especially the amount of traffic is small, and facility effectiveness got worse, it was difficult to build efficient communication system.
[0005] Then, it was made in order that this invention might solve the above technical problems, and it aims at offering the mobile communication system which can abolish the need of enabling it to correspond to a rapid change of the amount of traffic, and having a superfluous facility, and can raise facility effectiveness.
[0006]
[Means for Solving the Problem] the mobile terminal with which invention of claim 1 transmits and receives information, and between these mobile terminals -- or In the mobile communication system which has two or more base stations from which the communication link with a public line network is relayed, and the pin center,large station which is connected to said public line network and controls said each base station While providing an output-control means to control the magnitude of the sending-signal level outputted to said each base station from the transmitting output circuit which can change a

transmitting output level, and this transmitting output circuit by the command from said pin center,large station It has the configuration possessing the traffic control means which takes out a transmitting output adjustable command to said pin center,large station through said public line network at the output-control means of said base station.
[0007] Whenever the output-control means of said base station receives the transmitting output possible command outputted from said traffic control means of said pin center,large station in invention of claim 2, it has the configuration to which the transmitting output level outputted from the level [every] transmitting output circuit decided beforehand is changed.
[0008] Invention of claim 3 included output adjustable level information in the transmitting output adjustable command outputted from said traffic control means of said pin center,large station, and the output-control means of said base station is equipped with the configuration to which the transmitting output level outputted to the level according to said output adjustable level information from said transmitting output circuit is changed.
[0009] While invention of claim 4 forms a data report means to measure the current amount of traffic in the service area of a local station, and to transmit this to said pin center,large station through said public line network in said each base station A data collection means to receive the amount of traffic transmitted from said data report means of each base station, and to collect for every base station is formed in said pin center,large office. The traffic control means of said pin center,large office is equipped with the configuration which issues said transmitting output adjustable command based on the amount of traffic for every base station which said data collection means collected.
[0010] Invention of claim 5 is equipped with the configuration which transmits said amount of traffic to said pin center,large station when the report means of said base station receives the transmitting request of data from said data collection means of said pin center,large station.
[0011] If said traffic control means looks for the base station where the amount of traffic exceeded the threshold based on the amount of traffic for every base station which said data collection means collected and the corresponding base station is found in invention of claim 6, it is equipped with the configuration which takes out said transmitting output increase command which is a kind of said transmitting output adjustable command to the circumference base station of this base station.
[0012] Invention of claim 7 looked for the base station where the amount of traffic is the smallest in said circumference base station based on the amount of traffic for every base station to which said data collection means collected said traffic control means, and it has the configuration which takes out said transmitting output increase command to the base station of relevance.
[0013] Invention of claim 8 is based on the amount of traffic for every base station to which said data collection means collected said traffic control means. Look for the base station where the amount of traffic is the smallest in said circumference base station, and said transmitting output increase command is taken out to the base station of relevance. When the amount of traffic of said base station where the amount of traffic still exceeded the threshold at the beginning does not become below a threshold, said transmitting increase command is taken out to the base station where the amount of traffic is [2nd] the smallest in said circumference base station. Henceforth, the sequence that the amount of traffic is small is equipped with the configuration which takes out said transmitting output increase command to these base stations one by one in said circumference base station until the amount of traffic of said base station where the amount of traffic exceeded the threshold at the beginning becomes below a threshold.
[0014] Invention of claim 9 is equipped with the configuration with which it will take out said transmitting output increase command to the next base station if the transmitting output of the base station from which said traffic control means is taking out said transmitting output increase command becomes max.
[0015] Invention of claim 10 asked for the magnitude of the amount of the base station which increased the amount of traffic and the transmitting output of said base station whose amount of traffic exceeded the threshold at the beginning of traffic based on the amount of traffic for every base station which said data-collection means collected, and said traffic control means has in it the configuration which takes out said transmitting output reduction command which is a kind of said transmitting output adjustable

command to the base station which increased a transmitting output with this magnitude.
[0016] Invention of claim 11 has the configuration take out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which increased a transmitting output in said traffic control means, if it asks for the average of the amount of the base station which increased the amount of traffic and the transmitting output of said base station whose amount of traffic exceeded the threshold at the beginning of traffic based on the amount of traffic for every base station which said data-collection means collected and this average becomes below a predetermined value.
[0017] Invention of claim 12 calculated the amount of the base station which increased the amount of traffic and the transmitting output of said base station whose amount of traffic exceeded a threshold at the beginning of traffic based on the amount of traffic for every base station which said data-collection means collected, and said traffic control means has in it the configuration take out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which increased a transmitting output by the result performed and obtained various statistics processings in the amount of these traffic.
[0018] Invention of claim 13 is based on the amount of traffic for every base station to which said data collection means collected said traffic control means. Said transmitting output reduction command is taken out to the base station where the amount of traffic is the smallest in the base station which increased said transmitting output. Said transmitting output reduction command is taken out to the base station where the amount of traffic is [2nd] the smallest in the base station which increased said transmitting output when the average of said amount of traffic still did not become below a predetermined value. Henceforth, the sequence that the amount of traffic is small is equipped with the configuration which takes out said transmitting output reduction command to these base stations one by one in the base station which increased said transmitting output until the average of said amount of traffic becomes below a predetermined value.
[0019] Invention of claim 14 is equipped with the configuration with which it will take out said transmitting output reduction command to the next base station if the transmitting output of the base station from which said traffic control means is taking out said transmitting output reduction command becomes min.
[0020] Invention of claim 15 equipped said base station with the reception composition section which compounds the input signal by two or more receiving systems and these receiving systems, and is equipped with the configuration which makes the synthetic input signal of this reception composition section a final input signal.
[0021] Said each receiving system consisted of the antenna and the receive section, and invention of claim 16 is equipped with the configuration which uses the antenna of one receiving system also [antenna / for transmission].
[0022]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 is what showed the configuration of the gestalt of 1 operation of the mobile communication system of this invention, and is a block diagram at the time of applying this invention to a personal handy phone system (PHS) (CS1, SC2, CS3 --). The base station which 1 is connected to the ISDN public line network 2, and communicates by setting up a wireless circuit among the migration terminals 4a-4f which exist in the area of the base station concerned, It is the pin center,large station which performs each control of the mobile communication system concerned which 2 is connected to an ISDN public line network, and 3 is connected to the ISDN public line network 2, and includes control and a setup of the transmitting output of a base station 1, or various actuation. For example, it consists of the communication-interface section which connects a workstation and this workstation to the ISDN public line network 2. 4a-4f are mobile terminals, such as a portable telephone. In addition, base stations CS2 and CS3 have the same configuration as a base station CS 1.
[0023] In order that a base station 1 may enable it for a tooth-space diversity system to receive the sending signal from a mobile station certainly here, The antennas 19a-19d which give predetermined

spacing and are installed, respectively, The signal received with Antennas 19a-19d The receive section 12a-12d side, Or the RF switch section 11 which changes the signal inputted from the RF power amplification section 17 for transmission to Antennas [19a-19d] either, the receive sections 12a-12d which receive the sending signal from the mobile terminals 4a-4f caught with each antenna 19a-19d, A receive sections [12a-12d] input signal The reception composition section 13 and the ISDN public line network 2 to compound, and this base station The conveyance high frequency signal inputted from the attenuator 16 which adjusts the level of the conveyance high frequency signal outputted from the transmitting section 15 which outputs the conveyance high frequency signal modulated by the signal from the circuit interface section 14 and the circuit interface section 14 which connects, and the transmitting section 15, and an attenuator 16 The high-frequency power amplifier 17 and the attenuation level of an attenuator 16 which carry out power amplification are adjusted, or the amount of traffic of this base station is grasped, and it has CPU18 which performs each control of the whole other base stations of processings, such as telling a pin center,large station.

[0024] Drawing 2 is the block diagram having shown the example of a detail configuration of the above-mentioned base station. Receive sections 12a-12d have the receiving circuit 121 which receives the sending signal from a portable telephone, and the demodulator circuit 122 which restores to the input signal of this receiving circuit 121. Moreover, the TDMA decoding section 20 is formed between the reception composition section 13 and the circuit interface 14, and the recovery signal by which Time Division Multiplexing is carried out with the TDMA method compounded in the reception composition section 13 is outputted to an ISDN public line network through the circuit interface section 14, after separating the signal for every slot. Furthermore, the TDMA encoding section 21 is formed between the circuit interface section 14 and the transmitting section 15, and Time Division Multiplexing of two or more signals inputted from the circuit interface section 14 is carried out, and TDMA coding is carried out and it is outputting to the transmitting section 15. The transmitting section 15 has the modulation circuit 151 which modulates the signal by which TDMA coding was carried out, and the sending circuit 152 which makes a sending signal the modulating signal modulated in this modulation circuit 151.

[0025] Drawing 3 is the block diagram having shown the example of a detail configuration of the pin center,large office 3 shown in drawing 1 . The ROM which stores the RAM in which CPU which performs various processings of controlling the transmitting output of a base station while 31 controls this pin-center,large office, and 32 store various required data when CPU31 operates, the program whose 33 controls CPU31, the keyboard with which, as for 34, various commands etc. are keyed by the operator, the CRT as which 35 displays each information, and 36 are the communication interfaces which transmit and receive various information to an ISDN public line network 2. In addition, CPU31, RAM32, ROM33, a keyboard 34, and CRT35 grades may be the parts of a workstation etc.

[0026] Drawing 4 is drawing which arrangement of each base station which has the configuration shown in drawing 1 and drawing 2 , and each base station take charge of and in which having usually shown the range of the service area S at the time. In this example, seven base stations CS1-CS7 are arranged in the top-most vertices and the central point of six square shapes, as shown in drawing. Moreover, the service area S of base stations CS1-CS7 spreads out in the circle configuration centering on each base station, and it is arranged so that a part of each service area S may lap. The migration terminal in these seven service areas S can talk now over the telephone by setting up a wireless circuit between the base stations where the current location serves as a service area.

[0027] Next, actuation of the gestalt of this operation is explained. The pin center,large office 3 performs traffic data collection processing in which the flow chart as cyclically shown in drawing 5 was followed in order to grasp the amount of traffic of each base station (CS1, CS2, CS3 --). The data of the number of circuit currently used at the time of data collection processing are sufficient as the amount of traffic set as the object of data collection processing here, and since a circuit is used after the time of the last data collection, what integrated time amount is sufficient as it. That is, CPU31 of the pin center,large station 3 sends out the transmitting command of traffic data to the base station of relevance through the ISDN public line network 2 at step 501. CPU18 of the base station of relevance sends the current amount of traffic of a local station to the pin center,large station 3 through the ISDN public line

network 2 in response to this command from the circuit interface section 14. However, there are various methods in the procedure of transmission and reception of the traffic data between the pin center,large office 3 and a base station, and a transmitting command is not performed but you may make it each base station transmit traffic data automatically for every predetermined time from a pin center,large office.
[0028] This memorizes CPU31 of the pin center,large office 3 to a management table as receives the amount of traffic sent from said base station at step 502 and shows the obtained amount of traffic to drawing 6 set as RAM32. Then, when CPU31 returns to step 501 when judging whether the amounts of traffic were collected from all the base stations CS1-CS7 and not collecting, the above-mentioned processing is performed to the next base station and the amounts of traffic are collected from all the base stations CS1-CS7 at step 504, it ends processing.
[0029] Drawing 6 is the data table which collected the amounts of traffic of the base stations CS1-CS7 collected in the pin center,large office 3, as described above, and the list storage of the present amount of traffic for every bases CS [CS1-] 7 is carried out. This amount of traffic will be updated whenever the pin center,large office 3 performs processing shown in drawing 5 .
[0030] By the way, when the transmitting output of each base stations CS1-CS7 which constitute mobile communication system is a normal state, the service area S of each base stations CS1-CS7 came to be shown in drawing 4 . However, although the location H of high traffic of said mobile communication system changes every moment and is moved as shown in drawing 10 , the amount of traffic of the base station which exists in that case increases, and the telephone in the service area of the base station may stop being able to start easily. Although transmitting output increase processing of a circumference base station is performed in order for this example to mitigate the amount of traffic of the base station where the amount of traffic increased by the pin center,large office 3 in order to avoid such a situation in advance, and to always perform mobile communications smoothly, this processing is explained according to the flow chart of drawing 7 below.
[0031] The data table having shown in drawing 6 whether CPU31 of the pin center,large office 3 would have the base station where the amount of traffic exceeded the threshold at step 701 is searched, and when there is a base station of relevance, it progresses to step 702. CPU31 looks for the base station where the amount of traffic is the smallest from said data table in the surrounding base station of the base station which exceeded the threshold at step 702, and after deciding that the transmitting output of this base station is increased, it takes out a transmitting output increase command with step 703 to this base station through the ISDN public line network 2.
[0032] Here, when the base station beyond a threshold is the base station CS 1 of drawing 8 and the base station where the amount of traffic is the smallest is the base station CS 3 of drawing 8 in the base station of the circumference of it, the pin center,large office 3 will issue the transmitting output increase command described above to the base station CS 3.
[0033] CPU18 of the base station CS 3 which received said transmitting output increase command will increase the output of the electric wave which enlarges level of the conveyance high frequency signal inputted into the high-frequency power amplifier 17, and is transmitted from antenna 19d by making attenuation level of an attenuator 16 small according to the increase level information included during this increase command, if this command is received from the circuit interface section 14. Thereby, only as for the part to which said transmitting output increased, breadth and the range which overlaps the service area S of a base station CS 1 can spread, charge ****** can perform [a base station CS 3] a part of communication link which was being relayed in the base station CS 1 at this rate, and the service area S of a base station CS 3 can decrease the amount of traffic of a base station CS 1 as the result.
[0034] Next, the amount of traffic of the base station CS 1 where the amount of traffic which CPU31 checked again the data table shown in drawing 6 at step 704, and was searched at step 701 exceeded the threshold judges whether it is lower ******** below to said threshold. End processing, when it is, and when having not fallen, it progresses to step 705. Shimo -- **** -- It judges whether the transmitting output of the base station CS 3 which is increasing the current transmitting output is max, and if it is not max, it will return to step 703 and processing which increases further the transmitting output of this base station CS 3 will be performed.

[0035] When it judges with the transmitting output of said base station CS 3 being max at step 703 Except base station CS3 which progressed to step 706 and already increased the transmitting output The data table having judged, having returned to step 702 in a certain case, and having shown again whether there would be any base station which can increase a transmitting output in drawing 6 is checked. The base station where the amount of traffic is the smallest is looked for in the base station which can increase the remaining transmitting output, this base station is determined as the next base station for transmitting output increase, and it progresses to 703 or less-step processing. However, at step 706, when there is no base station which can increase a transmitting output, processing is ended.
[0036] By the case where the base station where traffic was over the threshold as mentioned above was CS1 here, and the base station which increased the transmitting output is CS3 When the traffic of a base station CS 1 becomes below a threshold in the phase which made max the transmitting output of this base station CS 3, The service area S of base stations CS1-CS7 becomes as [showed / in drawing 8]. The service area S of a base station CS 3 overlaps all the service areas S of a base station CS 1, and a base station CS 3 can relay the communication link of most number in the service area S of a base station CS 1 of mobile terminals, and can reduce the amount of traffic of a base station CS 1. of course, the part to which the amount of traffic of a base station CS 3 decreased in the amount of traffic of a base station CS 1 -- it will increase.
[0037] Next, transceiver actuation of the base station (CS1, CS2, CS3 --) shown in drawing 1 is explained. Time Division Multiplexing of the part for 4ch(es) is carried out in time by the TDAMA-TDD method, and, as for the signal transmitted and received between a base station and a mobile station, Time Division Multiplexing of a sending signal and the input signal is carried out further. The high frequency switch 11 changes to the high-frequency power amplifier 17 side by CPU18 at the time of transmission, for example, the output side of the high-frequency power amplifier 17 and antenna 19d are connected, and a sending signal is emitted as an electric wave from this antenna 19d. At this time, the attenuation level of an attenuator 16 is controlled by CPU18, the level of the sending signal inputted into the high-frequency power amplifier 17 from the transmitting section 15 is adjusted, the transmitting output outputted from the high-frequency power amplifier 17 is controlled, and the range of the service area S of these base stations (CS1, CS2, CS3 --) can be changed. However, when the attenuation level of an attenuator 16 is max, it has set up so that the transmitted power outputted from the high-frequency power amplifier 17 may usually be set to an output level.
[0038] on the other hand -- the time of reception -- the high frequency switch 11 -- CPU18 -- a receive sectiona [12],b [12], and 12c side and the 12d side -- changing -- for example, receive section 12a -- receive section 12c is connected to antenna 19c, and 12d of receive sections is connected to antenna 19d for antenna 19a and receive section 12b at antenna 19b. Therefore, receive sections 12a, 12b, 12c, and 12d receive the same signal transmitted from the mobile terminals 4a-4f which Antennas 19a, 19b, 19c, and 19d caught, compound the signal which restored to it to one signal by the reception composition section 13, and are outputted to the circuit interface section 14. By four receiving systems which consist of the above-mentioned antennas 19a, 19b, 19c, and 19d and receive sections 12a, 12b, 12c, and 12d here By receiving the same electric wave and compounding an input signal in the reception composition section 13 S/N of Antennas [19a, 19b, 19c, and 19d] directivity or an input signal is improvable. When a transmitting output is increased and a service area S is expanded, the signal from a distant mobile terminal can be received in sufficient quality, and communication link quality when expanding a service area S is carried out to beyond the fixed level.
[0039] Drawing 9 is other examples which showed the range of the service area S of each base stations CS1-CS7 of the result of having performed transmitting output increase processing of the circumference base station shown in drawing 7 . In this example, it is the base station CS 1 beyond a threshold, and traffic increases the transmitting output of the base stations CS2-CS7 which are around this to the maximum output in the small order of traffic, overlaps the service area S of a base station CS 1 in the service area S of all the base stations CS2-CS7 that are around it, and is reducing the amount of traffic of a base station CS 1.
[0040] Here, actuation of the base station set as the increase object of the above-mentioned transmitting

output is returned and explained to drawing 1 . If CPU18 receives the transmitting output increase command from the pin-center,large station 3 through the circuit interface section 14, it will control the part corresponding to the output change level contained in said command, and an attenuator 16, will decrease the attenuation level, will increase the level of the subcarrier high-frequency signal inputted into the high-frequency-power amplifier 17 from the transmitting section 15, and will increase the output of the sending signal which transmits from antenna 19d. Such control is performed whenever CPU18 receives a transmitting output increase command from the pin center,large station 3, it is carried out until the attenuation level of an attenuator 16 finally becomes zero, and it is this phase and the transmitting output of this base station becomes max.

[0041] In addition, it will be in the condition that the output, the call, and the service area S of each base station in this case usually showed the transmitting output in case the attenuation level of an attenuator 16 is max to drawing 4 . Moreover, the resistance of the level [every] attenuator 16 beforehand decided whenever CPU18 received the transmitting output increase command from the pin center,large station 3 unlike the above is changed, and you may make it decrease the attenuation level.

[0042] Next, although processing which usually returns the transmitting output of the base station where said transmitting output increased to an output must be performed when the amount of traffic decreases after the pin center,large office 3 increases the transmitting output of a base station, this processing is explained according to the flow chart of drawing 11 below.

[0043] CPU31 of the pin center,large office 3 calculates the average of the amount of traffic of the base station (the above-mentioned example CS1) where the amount of traffic exceeded the threshold at the beginning from the data table shown in drawing 6 at step 111, and the base station (the example of drawing 8 CS3) which increased the transmitting output, and when this average judges whether it became below a predetermined value and turns into below a predetermined value, it progresses to step 112. CPU31 looks for the base station where the amount of traffic is the smallest from said data table in the base station which increased the transmitting output at step 112, and after it decides the transmitting output of this base station to decrease, it takes out a transmitting output reduction command with step 113 to this base station through the ISDN public line network 2.

[0044] CPU18 of the base station used as said candidate for transmitting output reduction will decrease the output of the electric wave which makes small level of the conveyance high frequency signal inputted into the high-frequency power amplifier 17, and is transmitted from antenna 19d by enlarging change level on which the attenuation level of an attenuator 16 was directed by said command, if this command is received from the circuit interface section 14.

[0045] Here, when the base station where the amount of traffic exceeded the threshold is CS1 of drawing 8 and the base station for reduction of a transmitting output is CS3 of drawing 8 , the pin center,large office 3 will issue the transmitting output reduction command described above to the base station CS 3 at the beginning. The range where the service area S of a base station CS 3 overlaps the service area of narrowing and a base station CS 1 by this narrows, the number of communication links of the part to which said transmitting output decreased relayed in a base station CS 3 decreases at this rate, and the amount of traffic of a base station CS 1 increases as the result. However, since it is the phase whose amount of traffic of base stations CS1 and CS2 already decreased in this case, even if the amount of traffic of a base station CS 1 increases, it does not become the situation where a communication link is overdue.

[0046] Next, the average of the amount of traffic of the base station which CPU31 checked again the data table shown in drawing 6 at step 114, and was searched at step 111 judges whether it has become beyond said predetermined value. When having become and having not come to end processing, it progresses to step 115. It judges whether the transmitting output of the base station which is decreasing the transmitting output is min (usually output), and if it is not min, it will return to step 113 and processing which decreases the transmitting output of this base station further will be performed.

[0047] When it judges with the transmitting output of said base station being min at step 115 Progress to step 116 and the data table having judged, having returned to step 112 in a certain case, and having shown again whether there would be any other base station [that the transmitting output has still

increased] in drawing 6 is checked. The base station where the amount of traffic is the smallest is looked for in the base station which can decrease in number a transmitting output, this base station is determined as the next base station for transmitting output reduction, and it progresses to 113 or less-step processing. However, at step 116, when there is no base station which can decrease in number a transmitting output, processing is ended.

[0048] In addition, the resistance of the level [every] attenuator 16 beforehand decided whenever CPU18 received the transmitting output reduction command from the pin center,large station 3 unlike the above is changed, and you may make it increase the attenuation level. moreover, CPU31 of the pin center,large station 3 as criteria included in reduction processing of a transmitting output It asks for the magnitude of the amount of traffic of the base station (the above-mentioned example CS1) where the amount of traffic exceeded the threshold at the beginning from the data table shown in drawing 6 , and the base station (the example of drawing 8 CS3) which increased the transmitting output. Various statistics processings are performed to the amount of traffic of the base station (the above-mentioned example CS1) where good of this magnitude was carried out also as a ground, or the amount of traffic exceeded the threshold at the beginning, and the base station (the example of drawing 8 CS3) which increased the transmitting output, and it is good also considering that result as a ground.

[0049] Here, as shown in drawing 8 , it will follow on the amount of traffic of a base station CS 1 decreasing, and returning to the usual value in the example to which the transmitting output of base stations CS2-CS7 was increased, and the service area S was expanded, and the transmitting output of base stations CS2-CS7 will usually return to return and the normal state finally shown in drawing S one by one at a value.

[0050] In order to prevent change of the amount of traffic, especially stagnation of the communication link of the mobile terminal in the base station which increased the amount of traffic according to the gestalt of this operation, By overlapping and covering the service area S of the base station where the transmitting output of a surrounding base station was increased, and said amount of traffic increased in the service area S of the base station of said circumference By sharing with the base station of said circumference a part of communication link of the mobile terminal in the service area S of the base station where said amount of traffic increased, the amount of traffic of the base station where said amount of traffic increased can be decreased, and a mobile terminal can always be communicated smoothly.

[0051] This example moreover, by raising the transmitting output of a surrounding base station, increasing the amount of traffic of these base stations, when the amount of traffic of one base station increases, and equalizing the amount of traffic of a base station by change of the amount of traffic Since it can respond to a high traffic condition by equalizing the operating ratio of each base station etc. and it is not necessary to have a facility of a superfluous base station etc., the installation expense and employment expense of a facility can be held down and an efficient system can be built.

[0052] Furthermore, if the amount of traffic decreases, since the transmitting output of the base station which increased the transmitting output promptly will be returned to the original usual value and the service area S will usually be made into the range, interference between base stations can be pressed down to the minimum. Moreover, since it is quality with sufficient S/N and the signal from a distant mobile terminal can be received when a transmitting output is increased and a service area S is extended in this example, since it has four receiving systems of a base station including the antenna, the quality of the communication link through the base station which increased the transmitting output as mentioned above and extended the service area S can be held good. in addition, the personal handy phone system by which each base station is connected with the pin center,large station through the public line as an example of a gestalt of the operation explained above -- an example -- ** -- natural, although explained by carrying out -- each base station and a pin center,large station can apply to the common cellular-phone system connected by the dedicated line.

[0053]

[Effect of the Invention] it described above -- as -- claim 1 thru/or 3 -- according to mobile communication system given in either, it can respond to increase of the amount of traffic dynamically by

changing the range of a service area by making the transmitting output of each base station adjustable corresponding to change of the amount of traffic.
[0054] According to mobile communication system according to claim 4 or 5, the amounts of traffic of each base station can be collected to a pin center,large office, and a pin center,large office can change the transmitting output of each base station based on this collection data.
[0055] According to mobile communication system according to claim 6 or 7, the amount of traffic can perform control which decreases the amount of traffic of the base station which became large, and can communicate a mobile terminal smoothly.
[0056] While being able to communicate a mobile terminal smoothly by increasing the transmitting output of two or more base stations, and decreasing the amount of traffic of the base station where the amount of traffic became large according to mobile communication system according to claim 8 or 9, the need of having a superfluous facility can be abolished and facility effectiveness can be raised.
[0057] claim 10 thru/or 14 -- according to mobile communication system given in either, if the amount of traffic decreases, the transmitting output of the base station which increased the transmitting output promptly can be decreased, and interference between base stations can be suppressed to the minimum.
[0058] According to mobile communication system according to claim 15 or 16, even if a service area is expanded, communication link quality can be held good.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the configuration which carries out adjustable [of especially the transmitting output of a base station] with respect to the mobile communication system which performs the communication link of mobile terminals, such as a portable telephone, through a base station.

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PRIOR ART

[Description of the Prior Art] In mobile communication system, the magnitude of the service area S of each base stations CS1-CS7 is being fixed like drawing 12 from the former. Therefore, in the service area S where it is assumed that there are many amounts of traffic, although the number of wireless circuits was increased so that it could respond to the amount of traffic of extent assumed, it corresponded by arranging a base station densely.
[0003] However, since the amount of traffic changes every moment while changing with locations, it is difficult to expect beforehand how the amount of traffic changes. Therefore, it the amount of traffic changed rapidly, the radio channel of the opening which should be assigned to a message is lost and a message becomes impossible. therefore, since hurt **** 7 and installation and employment expense increase, a facility became superfluous when especially the amount of traffic is small and facility effectiveness got worse if an installation, number, etc. of base stations are not set up with allowances so that it can respond, even if said amount of traffic becomes quite large, it was difficult to build efficient communication system.

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EFFECT OF THE INVENTION

[Effect of the Invention] it described above -- as -- claim 1 thru/or 3 -- according to mobile communication system given in either, it can respond to increase of the amount of traffic dynamically by changing the range of a service area by making the transmitting output of each base station adjustable corresponding to change of the amount of traffic.
[0054] According to mobile communication system according to claim 4 or 5, the amounts of traffic of each base station can be collected to a pin center,large office, and a pin center,large office can change the transmitting output of each base station based on this collection data.
[0055] According to mobile communication system according to claim 6 or 7, the amount of traffic can perform control which decreases the amount of traffic of the base station which became large, and can communicate a mobile terminal smoothly.
[0056] While being able to communicate a mobile terminal smoothly by increasing the transmitting output of two or more base stations, and decreasing the amount of traffic of the base station where the amount of traffic became large according to mobile communication system according to claim 8 or 9, the need of having a superfluous facility can be abolished and facility effectiveness can be raised.
[0057] claim 10 thru/or 14 -- according to mobile communication system given in either, if the amount of traffic decreases, the transmitting output of the base station which increased the transmitting output promptly can be decreased, and interference between base stations can be suppressed to the minimum.
[0058] According to mobile communication system according to claim 15 or 16, even if a service area is expanded, communication link quality can be held good.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] since the above conventional mobile communication system hurts **** 7 if an installation, number, etc. of base stations are not set up with allowances so that it can respond, even if said amount of traffic becomes quite large since it corresponds to the amount of traffic which changes every moment, installation and employment expense increase, a facility became superfluous when especially the amount of traffic is small, and facility effectiveness got worse, it was difficult to build efficient communication system.
[0005] Then, it was made in order that this invention might solve the above technical problems, and it aims at offering the mobile communication system which can abolish the need of enabling it to correspond to a rapid change of the amount of traffic, and having a superfluous facility, and can raise facility effectiveness.

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MEANS

[Means for Solving the Problem] the mobile terminal with which invention of claim 1 transmits and receives information, and between these mobile terminals -- or In the mobile communication system which has two or more base stations from which the communication link with a public line network is relayed, and the pin center,large station which is connected to said public line network and controls said each base station While providing an output-control means to control the magnitude of the sending-signal level outputted to said each base station from the transmitting output circuit which can change a transmitting output level, and this transmitting output circuit by the command from said pin center,large station It has the configuration possessing the traffic control means which takes out a transmitting output adjustable command to said pin center,large station through said public line network at the output-control means of said base station.
[0007] Whenever the output-control means of said base station receives the transmitting output possible command outputted from said traffic control means of said pin center,large station in invention of claim 2, it has the configuration to which the transmitting output level outputted from the level [every] transmitting output circuit decided beforehand is changed.
[0008] Invention of claim 3 included output adjustable level information in the transmitting output adjustable command outputted from said traffic control means of said pin center,large station, and the output-control means of said base station is equipped with the configuration to which the transmitting output level outputted to the level according to said output adjustable level information from said transmitting output circuit is changed.
[0009] While invention of claim 4 forms a data report means to measure the current amount of traffic in the service area of a local station, and to transmit this to said pin center,large station through said public line network in said each base station A data collection means to receive the amount of traffic transmitted from said data report means of each base station, and to collect for every base station is formed in said pin center,large office. The traffic control means of said pin center,large office is equipped with the configuration which issues said transmitting output adjustable command based on the amount of traffic for every base station which said data collection means collected.
[0010] Invention of claim 5 is equipped with the configuration which transmits said amount of traffic to said pin center,large station when the report means of said base station receives the transmitting request of data from said data collection means of said pin center,large station.
[0011] If said traffic control means looks for the base station where the amount of traffic exceeded the threshold based on the amount of traffic for every base station which said data collection means collected and the corresponding base station is found in invention of claim 6, it is equipped with the configuration which takes out said transmitting output increase command which is a kind of said transmitting output adjustable command to the circumference base station of this base station.
[0012] Invention of claim 7 looked for the base station where the amount of traffic is the smallest in said circumference base station based on the amount of traffic for every base station to which said data collection means collected said traffic control means, and it has the configuration which takes out said transmitting output increase command to the base station of relevance.

[0013] Invention of claim 8 is based on the amount of traffic for every base station to which said data collection means collected said traffic control means. Look for the base station where the amount of traffic is the smallest in said circumference base station, and said transmitting output increase command is taken out to the base station of relevance. When the amount of traffic of said base station where the amount of traffic still exceeded the threshold at the beginning does not become below a threshold, said transmitting increase command is taken out to the base station where the amount of traffic is [2nd] the smallest in said circumference base station. Henceforth, the sequence that the amount of traffic is small is equipped with the configuration which takes out said transmitting output increase command to these base stations one by one in said circumference base station until the amount of traffic of said base station where the amount of traffic exceeded the threshold at the beginning becomes below a threshold.
[0014] Invention of claim 9 is equipped with the configuration with which it will take out said transmitting output increase command to the next base station if the transmitting output of the base station from which said traffic control means is taking out said transmitting output increase command becomes max.
[0015] Invention of claim 10 asked for the magnitude of the amount of the base station which increased the amount of traffic and the transmitting output of said base station whose amount of traffic exceeded the threshold at the beginning of traffic based on the amount of traffic for every base station which said data-collection means collected, and said traffic control means has in it the configuration which takes out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which increased a transmitting output with this magnitude.
[0016] Invention of claim 11 has the configuration take out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which increased a transmitting output in said traffic control means, if it asks for the average of the amount of the base station which increased the amount of traffic and the transmitting output of said base station whose amount of traffic exceeded the threshold at the beginning of traffic based on the amount of traffic for every base station which said data-collection means collected and this average becomes below a predetermined value.
[0017] Invention of claim 12 calculated the amount of the base station which increased the amount of traffic and the transmitting output of said base station whose amount of traffic exceeded a threshold at the beginning of traffic based on the amount of traffic for every base station which said data-collection means collected, and said traffic control means has in it the configuration take out said transmitting output reduction command which is a kind of said transmitting output adjustable command to the base station which increased a transmitting output by the result performed and obtained various statistics processings in the amount of these traffic.
[0018] Invention of claim 13 is based on the amount of traffic for every base station to which said data collection means collected said traffic control means. Said transmitting output reduction command is taken out to the base station where the amount of traffic is the smallest in the base station which increased said transmitting output. Said transmitting output reduction command is taken out to the base station where the amount of traffic is [2nd] the smallest in the base station which increased said transmitting output when the average of said amount of traffic still did not become below a predetermined value. Henceforth, the sequence that the amount of traffic is small is equipped with the configuration which takes out said transmitting output reduction command to these base stations one by one in the base station which increased said transmitting output until the average of said amount of traffic becomes below a predetermined value.
[0019] Invention of claim 14 is equipped with the configuration with which it will take out said transmitting output reduction command to the next base station if the transmitting output of the base station from which said traffic control means is taking out said transmitting output reduction command becomes min.
[0020] Invention of claim 15 equipped said base station with the reception composition section which compounds the input signal by two or more receiving systems and these receiving systems, and is equipped with the configuration which makes the synthetic input signal of this reception composition

section a final input signal.
[0021] Said each receiving system consisted of the antenna and the receive section, and invention of claim 16 is equipped with the configuration which uses the antenna of one receiving system also [antenna / for transmission].
[0022]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 is what showed the configuration of the gestalt of 1 operation of the mobile communication system of this invention, and is a block diagram at the time of applying this invention to a personal handy phone system (PHS) (CS1, SC2, CS3 --). The base station which 1 is connected to the ISDN public line network 2, and communicates by setting up a wireless circuit among the migration terminals 4a-4f which exist in the area of the base station concerned, It is the pin center,large station which performs each control of the mobile communication system concerned which 2 is connected to an ISDN public line network, and 3 is connected to the ISDN public line network 2, and includes control and a setup of the transmitting output of a base station 1, or various actuation. For example, it consists of the communication-interface section which connects a workstation and this workstation to the ISDN public line network 2. 4a-4f are mobile terminals, such as a portable telephone. In addition, base stations CS2 and CS3 have the same configuration as a base station CS 1.
[0023] In order that a base station 1 may enable it for a tooth-space diversity system to receive the sending signal from a mobile station certainly here, The antennas 19a-19d which give predetermined spacing and are installed, respectively, The signal received with Antennas 19a-19d The receive section 12a-12d side, Or the RF switch section 11 which changes the signal inputted from the RF power amplification section 17 for transmission to Antennas [19a-19d] either, the receive sections 12a-12d which receive the sending signal from the mobile terminals 4a-4f caught with each antenna 19a-19d, A receive sections [12a-12d] input signal The reception composition section 13 and the ISDN public line network 2 to compound, and this base station The conveyance high frequency signal inputted from the attenuator 16 which adjusts the level of the conveyance high frequency signal outputted from the transmitting section 15 which outputs the conveyance high frequency signal modulated by the signal from the circuit interface section 14 and the circuit interface section 14 which connects, and the transmitting section 15, and an attenuator 16 The high-frequency power amplifier 17 and the attenuation level of an attenuator 16 which carry out power amplification are adjusted, or the amount of traffic of this base station is grasped, and it has CPU18 which performs each control of the whole other base stations of processings, such as telling a pin center,large station.
[0024] Drawing 2 is the block diagram having shown the example of a detail configuration of the above-mentioned base station. Receive sections 12a-12d have the receiving circuit 121 which receives the sending signal from a portable telephone, and the demodulator circuit 122 which restores to the input signal of this receiving circuit 121. Moreover, the TDMA decoding section 20 is formed between the reception composition section 13 and the circuit interface 14, and the recovery signal by which Time Division Multiplexing is carried out with the TDMA method compounded in the reception composition section 13 is outputted to an ISDN public line network through the circuit interface section 14, after separating the signal for every slot. Furthermore, the TDMA encoding section 21 is formed between the circuit interface section 14 and the transmitting section 15, and Time Division Multiplexing of two or more signals inputted from the circuit interface section 14 is carried out, and TDMA coding is carried out and it is outputting to the transmitting section 15. The transmitting section 15 has the modulation circuit 151 which modulates the signal by which TDMA coding was carried out, and the sending circuit 152 which makes a sending signal the modulating signal modulated in this modulation circuit 151.
[0025] Drawing 3 is the block diagram having shown the example of a detail configuration of the pin center,large office 3 shown in drawing 1 . The ROM which stores the RAM in which CPU which performs various processings of controlling the transmitting output of a base station while 31 controls this pin-center,large office, and 32 store various required data when CPU31 operates, the program whose 33 controls CPU31, the keyboard with which, as for 34, various commands etc. are keyed by the operator, the CRT as which 35 displays each information, and 36 are the communication interfaces

which transmit and receive various information to an ISDN public line network 2. In addition, CPU31, RAM32, ROM33, a keyboard 34, and CRT35 grades may be the parts of a workstation etc.
[0026] Drawing 4 is drawing which arrangement of each base station which has the configuration shown in drawing 1 and drawing 2 , and each base station take charge of and in which having usually shown the range of the service area S at the time. In this example, seven base stations CS1-CS7 are arranged in the top-most vertices and the central point of six square shapes, as shown in drawing. Moreover, the service area S of base stations CS1-CS7 spreads out in the circle configuration centering on each base station, and it is arranged so that a part of each service area S may lap. The migration terminal in these seven service areas S can talk now over the telephone by setting up a wireless circuit between the base stations where the current location serves as a service area.
[0027] Next, actuation of the gestalt of this operation is explained. The pin center,large office 3 performs traffic data collection processing in which the flow chart as cyclically shown in drawing 5 was followed in order to grasp the amount of traffic of each base station (CS1, CS2, CS3 --). The data of the number of circuit currently used at the time of data collection processing are sufficient as the amount of traffic set as the object of data collection processing here, and since a circuit is used after the time of the last data collection, what integrated time amount is sufficient as it. That is, CPU31 of the pin center,large station 3 sends out the transmitting command of traffic data to the base station of relevance through the ISDN public line network 2 at step 501. CPU18 of the base station of relevance sends the current amount of traffic of a local station to the pin center,large station 3 through the ISDN public line network 2 in response to this command from the circuit interface section 14. However, there are various methods in the procedure of transmission and reception of the traffic data between the pin center,large office 3 and a base station, and a transmitting command is not performed but you may make it each base station transmit traffic data automatically for every predetermined time from a pin center,large office.
[0028] This memorizes CPU31 of the pin center,large office 3 to a management table as receives the amount of traffic sent from said base station at step 502 and shows the obtained amount of traffic to drawing 6 set as RAM32. Then, when CPU31 returns to step 501 when judging whether the amounts of traffic were collected from all the base stations CS1-CS7 and not collecting, the above-mentioned processing is performed to the next base station and the amounts of traffic are collected from all the base stations CS1-CS7 at step 504, it ends processing.
[0029] Drawing 6 is the data table which collected the amounts of traffic of the base stations CS1-CS7 collected in the pin center,large office 3, as described above, and the list storage of the present amount of traffic for every bases CS [CS1-] 7 is carried out. This amount of traffic will be updated whenever the pin center,large office 3 performs processing shown in drawing 5 .
[0030] By the way, when the transmitting output of each base stations CS1-CS7 which constitute mobile communication system is a normal state, the service area S of each base stations CS1-CS7 came to be shown in drawing 4 . However, although the location H of high traffic of said mobile communication system changes every moment and is moved as shown in drawing 10 , the amount of traffic of the base station which exists in that case increases, and the telephone in the service area of the base station may stop being able to start easily. Although transmitting output increase processing of a circumference base station is performed in order for this example to mitigate the amount of traffic of the base station where the amount of traffic increased by the pin center,large office 3 in order to avoid such a situation in advance, and to always perform mobile communications smoothly, this processing is explained according to the flow chart of drawing 7 below.
[0031] The data table having shown in drawing 6 whether CPU31 of the pin center,large office 3 would have the base station where the amount of traffic exceeded the threshold at step 701 is searched, and when there is a base station of relevance, it progresses to step 702. CPU31 looks for the base station where the amount of traffic is the smallest from said data table in the surrounding base station of the base station which exceeded the threshold at step 702, and after deciding that the transmitting output of this base station is increased, it takes out a transmitting output increase command with step 703 to this base station through the ISDN public line network 2.
[0032] Here, when the base station beyond a threshold is the base station CS 1 of drawing 8 and the base

station where the amount of traffic is the smallest is the base station CS 3 of drawing 8 in the base station of the circumference of it, the pin center,large office 3 will issue the transmitting output increase command described above to the base station CS 3.
[0033] CPU18 of the base station CS 3 which received said transmitting output increase command will increase the output of the electric wave which enlarges level of the conveyance high frequency signal inputted into the high-frequency power amplifier 17, and is transmitted from antenna 19d by making attenuation level of an attenuator 16 small according to the increase level information included during this increase command, if this command is received from the circuit interface section 14. Thereby, only as for the part to which said transmitting output increased, breadth and the range which overlaps the service area S of a base station CS 1 can spread, charge ****** can perform [a base station CS 3] a part of communication link which was being relayed in the base station CS 1 at this rate, and the service area S of a base station CS 3 can decrease the amount of traffic of a base station CS 1 as the result.
[0034] Next, the amount of traffic of the base station CS 1 where the amount of traffic which CPU31 checked again the data table shown in drawing 6 at step 704, and was searched at step 701 exceeded the threshold judges whether it is lower ******** below to said threshold. End processing, when it is, and when having not fallen, it progresses to step 705. Shimo -- **** -- It judges whether the transmitting output of the base station CS 3 which is increasing the current transmitting output is max, and if it is not max, it will return to step 703 and processing which increases further the transmitting output of this base station CS 3 will be performed.
[0035] When it judges with the transmitting output of said base station CS 3 being max at step 703 Except base station CS3 which progressed to step 706 and already increased the transmitting output The data table having judged, having returned to step 702 in a certain case, and having shown again whether there would be any base station which can increase a transmitting output in drawing 6 is checked. The base station where the amount of traffic is the smallest is looked for in the base station which can increase the remaining transmitting output, this base station is determined as the next base station for transmitting output increase, and it progresses to 703 or less-step processing. However, at step 706, when there is no base station which can increase a transmitting output, processing is ended.
[0036] By the case where the base station where traffic was over the threshold as mentioned above was CS1 here, and the base station which increased the transmitting output is CS3 When the traffic of a base station CS 1 becomes below a threshold in the phase which made max the transmitting output of this base station CS 3, The service area S of base stations CS1-CS7 becomes as [showed / in drawing 8]. The service area S of a base station CS 3 overlaps all the service areas S of a base station CS 1, and a base station CS 3 can relay the communication link of most number in the service area S of a base station CS 1 of mobile terminals, and can reduce the amount of traffic of a base station CS 1. of course, the part to which the amount of traffic of a base station CS 3 decreased in the amount of traffic of a base station CS 1 -- it will increase.
[0037] Next, transceiver actuation of the base station (CS1, CS2, CS3 --) shown in drawing 1 is explained. Time Division Multiplexing of the part for 4ch(es) is carried out in time by the TDAMA-TDD method, and, as for the signal transmitted and received between a base station and a mobile station, Time Division Multiplexing of a sending signal and the input signal is carried out further. The high frequency switch 11 changes to the high-frequency power amplifier 17 side by CPU18 at the time of transmission, for example, the output side of the high-frequency power amplifier 17 and antenna 19d are connected, and a sending signal is emitted as an electric wave from this antenna 19d. At this time, the attenuation level of an attenuator 16 is controlled by CPU18, the level of the sending signal inputted into the high-frequency power amplifier 17 from the transmitting section 15 is adjusted, the transmitting output outputted from the high-frequency power amplifier 17 is controlled, and the range of the service area S of these base stations (CS1, CS2, CS3 --) can be changed. However, when the attenuation level of an attenuator 16 is max, it has set up so that the transmitted power outputted from the high-frequency power amplifier 17 may usually be set to an output level.
[0038] on the other hand -- the time of reception -- the high frequency switch 11 -- CPU18 -- a receive sectiona [12],b [12], and 12c side and the 12d side -- changing -- for example, receive section 12a --

receive section 12c is connected to antenna 19c, and 12d of receive sections is connected to antenna 19d for antenna 19a and receive section 12b at antenna 19b. Therefore, receive sections 12a, 12b, 12c, and 12d receive the same signal transmitted from the mobile terminals 4a-4f which Antennas 19a, 19b, 19c, and 19d caught, compound the signal which restored to it to one signal by the reception composition section 13, and are outputted to the circuit interface section 14. By four receiving systems which consist of the above-mentioned antennas 19a, 19b, 19c, and 19d and receive sections 12a, 12b, 12c, and 12d here By receiving the same electric wave and compounding an input signal in the reception composition section 13 S/N of Antennas [19a, 19b, 19c, and 19d] directivity or an input signal is improvable. When a transmitting output is increased and a service area S is expanded, the signal from a distant mobile terminal can be received in sufficient quality, and communication link quality when expanding a service area S is carried out to beyond the fixed level.

[0039] Drawing 9 is other examples which showed the range of the service area S of each base stations CS1-CS7 of the result of having performed transmitting output increase processing of the circumference base station shown in drawing 7 . In this example, it is the base station CS 1 beyond a threshold, and traffic increases the transmitting output of the base stations CS2-CS7 which are around this to the maximum output in the small order of traffic, overlaps the service area S of a base station CS 1 in the service area S of all the base stations CS2-CS7 that are around it, and is reducing the amount of traffic of a base station CS 1.

[0040] Here, actuation of the base station set as the increase object of the above-mentioned transmitting output is returned and explained to drawing 1 . If CPU18 receives the transmitting output increase command from the pin-center,large station 3 through the circuit interface section 14, it will control the part corresponding to the output change level contained in said command, and an attenuator 16, will decrease the attenuation level, will increase the level of the subcarrier high-frequency signal inputted into the high-frequency-power amplifier 17 from the transmitting section 15, and will increase the output of the sending signal which transmits from antenna 19d. Such control is performed whenever CPU18 receives a transmitting output increase command from the pin center,large station 3, it is carried out until the attenuation level of an attenuator 16 finally becomes zero, and it is this phase and the transmitting output of this base station becomes max.

[0041] In addition, it will be in the condition that the output, the call, and the service area S of each base station in this case usually showed the transmitting output in case the attenuation level of an attenuator 16 is max to drawing 4 . Moreover, the resistance of the level [every] attenuator 16 beforehand decided whenever CPU18 received the transmitting output increase command from the pin center,large station 3 unlike the above is changed, and you may make it decrease the attenuation level.

[0042] Next, although processing which usually returns the transmitting output of the base station where said transmitting output increased to an output must be performed when the amount of traffic decreases after the pin center,large office 3 increases the transmitting output of a base station, this processing is explained according to the flow chart of drawing 11 below.

[0043] CPU31 of the pin center,large office 3 calculates the average of the amount of traffic of the base station (the above-mentioned example CS1) where the amount of traffic exceeded the threshold at the beginning from the data table shown in drawing 6 at step 111, and the base station (the example of drawing 8 CS3) which increased the transmitting output, and when this average judges whether it became below a predetermined value and turns into below a predetermined value, it progresses to step 112. CPU31 looks for the base station where the amount of traffic is the smallest from said data table in the base station which increased the transmitting output at step 112, and after it decides the transmitting output of this base station to decrease, it takes out a transmitting output reduction command with step 113 to this base station through the ISDN public line network 2.

[0044] CPU18 of the base station used as said candidate for transmitting output reduction will decrease the output of the electric wave which makes small level of the conveyance high frequency signal inputted into the high-frequency power amplifier 17, and is transmitted from antenna 19d by enlarging change level on which the attenuation level of an attenuator 16 was directed by said command, if this command is received from the circuit interface section 14.

[0045] Here, when the base station where the amount of traffic exceeded the threshold is CS1 of drawing 8 and the base station for reduction of a transmitting output is CS3 of drawing 8 , the pin center,large office 3 will issue the transmitting output reduction command described above to the base station CS 3 at the beginning. The range where the service area S of a base station CS 3 overlaps the service area of narrowing and a base station CS 1 by this narrows, the number of communication links of the part to which said transmitting output decreased relayed in a base station CS 3 decreases at this rate, and the amount of traffic of a base station CS 1 increases as the result. However, since it is the phase whose amount of traffic of base stations CS1 and CS2 already decreased in this case, even if the amount of traffic of a base station CS 1 increases, it does not become the situation where a communication link is overdue.

[0046] Next, the average of the amount of traffic of the base station which CPU31 checked again the data table shown in drawing 6 at step 114, and was searched at step 111 judges whether it has become beyond said predetermined value. When having become and having not come to end processing, it progresses to step 115. It judges whether the transmitting output of the base station which is decreasing the transmitting output is min (usually output), and if it is not min, it will return to step 113 and processing which decreases the transmitting output of this base station further will be performed.

[0047] When it judges with the transmitting output of said base station being min at step 115 Progress to step 116 and the data table having judged, having returned to step 112 in a certain case, and having shown again whether there would be any other base station [that the transmitting output has still increased] in drawing 6 is checked. The base station where the amount of traffic is the smallest is looked for in the base station which can decrease in number a transmitting output, this base station is determined as the next base station for transmitting output reduction, and it progresses to 113 or less-step processing. However, at step 116, when there is no base station which can decrease in number a transmitting output, processing is ended.

[0048] In addition, the resistance of the level [every] attenuator 16 beforehand decided whenever CPU18 received the transmitting output reduction command from the pin center,large station 3 unlike the above is changed, and you may make it increase the attenuation level. moreover, CPU31 of the pin center,large station 3 as criteria included in reduction processing of a transmitting output It asks for the magnitude of the amount of traffic of the base station (the above-mentioned example CS1) where the amount of traffic exceeded the threshold at the beginning from the data table shown in drawing 6 , and the base station (the example of drawing 8 CS3) which increased the transmitting output. Various statistics processings are performed to the amount of traffic of the base station (the above-mentioned example CS1) where good of this magnitude was carried out also as a ground, or the amount of traffic exceeded the threshold at the beginning, and the base station (the example of drawing 8 CS3) which increased the transmitting output, and it is good also considering that result as a ground.

[0049] Here, as shown in drawing 8 , it will follow on the amount of traffic of a base station CS 1 decreasing, and returning to the usual value in the example to which the transmitting output of base stations CS2-CS7 was increased, and the service area S was expanded, and the transmitting output of base stations CS2-CS7 will usually return to return and the normal state finally shown in drawing S one by one at a value.

[0050] In order to prevent change of the amount of traffic, especially stagnation of the communication link of the mobile terminal in the base station which increased the amount of traffic according to the gestalt of this operation, By overlapping and covering the service area S of the base station where the transmitting output of a surrounding base station was increased, and said amount of traffic increased in the service area S of the base station of said circumference By sharing with the base station of said circumference a part of communication link of the mobile terminal in the service area S of the base station where said amount of traffic increased, the amount of traffic of the base station where said amount of traffic increased can be decreased, and a mobile terminal can always be communicated smoothly.

[0051] This example moreover, by raising the transmitting output of a surrounding base station, increasing the amount of traffic of these base stations, when the amount of traffic of one base station

increases, and equalizing the amount of traffic of a base station by change of the amount of traffic Since it can respond to a high traffic condition by equalizing the operating ratio of each base station etc. and it is not necessary to have a facility of a superfluous base station etc., the installation expense and employment expense of a facility can be held down and an efficient system can be built.

[0052] Furthermore, if the amount of traffic decreases, since the transmitting output of the base station which increased the transmitting output promptly will be returned to the original usual value and the service area S will usually be made into the range, interference between base stations can be pressed down to the minimum. Moreover, since it is quality with sufficient S/N and the signal from a distant mobile terminal can be received when a transmitting output is increased and a service area S is extended in this example, since it has four receiving systems of a base station including the antenna, the quality of the communication link through the base station which increased the transmitting output as mentioned above and extended the service area S can be held good. in addition, the personal handy phone system by which each base station is connected with the pin center,large station through the public line as an example of a gestalt of the operation explained above -- an example -- ** -- natural, although explained by carrying out -- each base station and a pin center,large station can apply to the common cellular-phone system connected by the dedicated line.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram having shown the configuration of the gestalt of 1 operation of the mobile communication system of this invention.
[Drawing 2] The block diagram having shown the example of a detail of the base station shown in drawing 1 .
[Drawing 3] The block diagram having shown the example of a detail of the pin center,large office shown in drawing 1 .
[Drawing 4] Drawing having shown the arrangement and the range of a service area of the base station of the mobile communication system shown in drawing 1 .
[Drawing 5] The flow chart which showed the processing which collects the amounts of traffic of each base station of the pin center,large office shown in drawing 1 .
[Drawing 6] Drawing in which having been set up in RAM shown in drawing 3 , and having shown an example of a data table.
[Drawing 7] The flow chart which showed increase processing of the transmitting output of the base station by the pin center,large office shown in drawing 1 .
[Drawing 8] Drawing having shown the condition of having increased one transmitting output of the base station of the mobile communication system shown in drawing 1 , and having expanded the range of the service area.
[Drawing 9] Drawing having shown the condition of having increased two or more transmitting outputs of the mobile communication system shown in drawing 1 , and having expanded the range of the service area.
[Drawing 10] Drawing having shown the condition that the increase part of the amount of traffic moved in the mobile communication system shown in drawing 1 .
[Drawing 11] The flow chart which showed reduction processing of the transmitting output of the base station by the pin center,large office shown in drawing 1 .
[Drawing 12] Drawing having shown the arrangement and the range of a service area of the base station of the conventional mobile communication system.
[Description of Notations]
1 (CS1-CS7) -- Base station
2 -- ISDN public line network
3 -- Pin center,large station
11 -- High frequency switch
12a-12d -- Receive section
13 -- Reception composition section
14 -- Circuit interface section
15 -- Transmitting section
16 -- Attenuator
17 -- RF power amplification section

18 31 -- CPU
19a-19d -- Antenna
32 -- RAM
33 -- ROM
34 -- Keyboard
35 -- CRT
36 -- Communication interface

[Translation done.]

* NOTICES *

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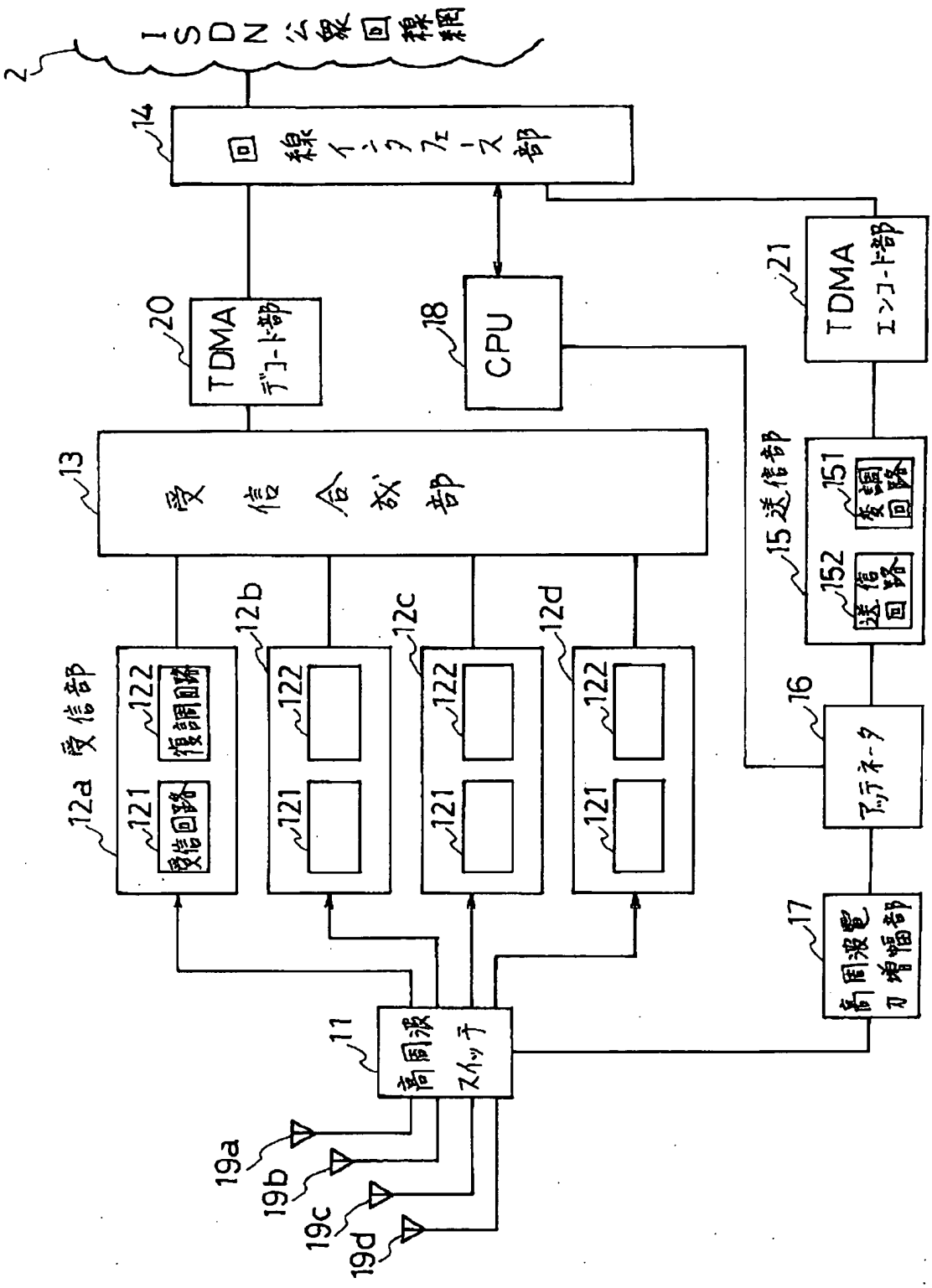
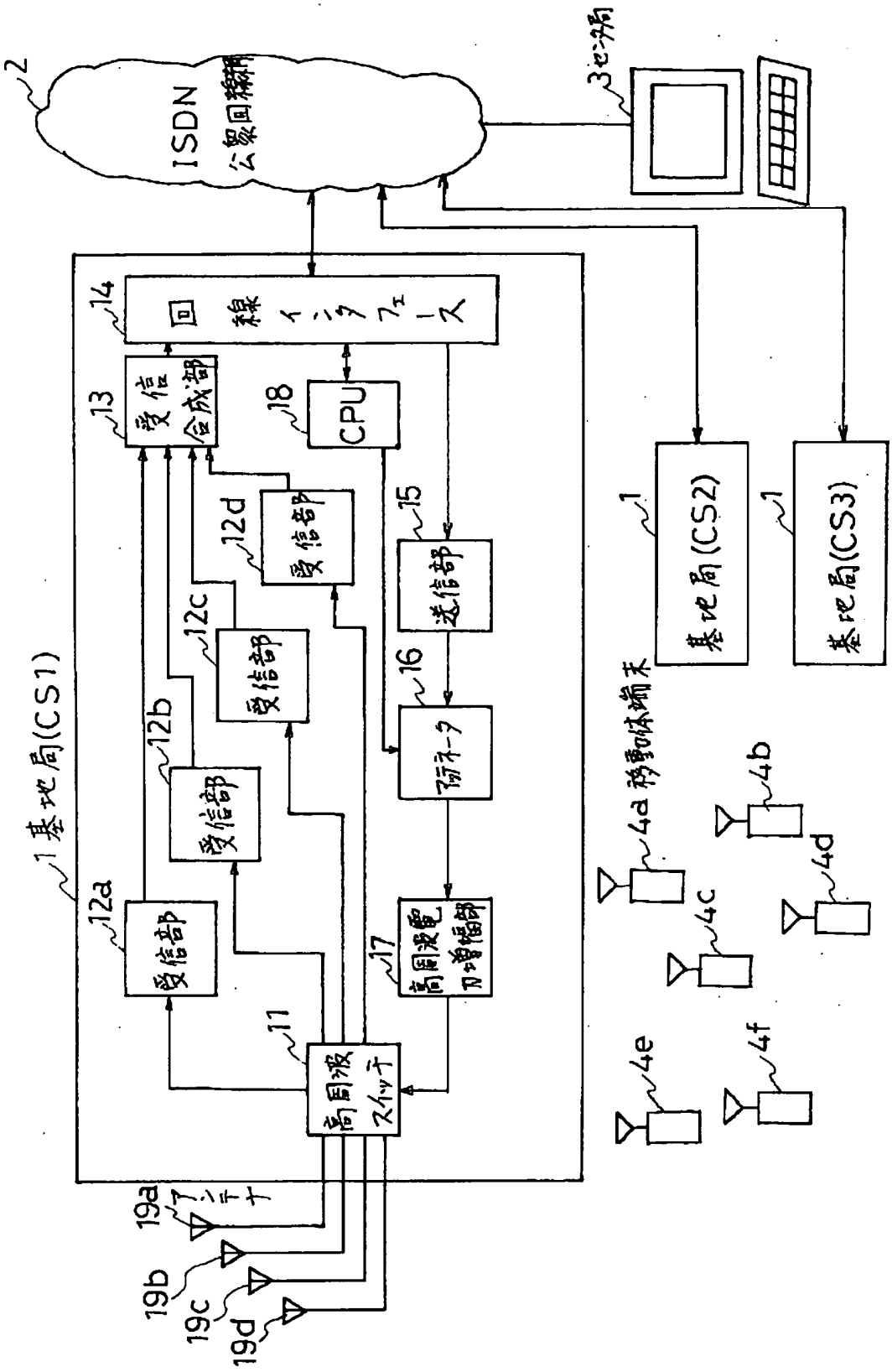
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

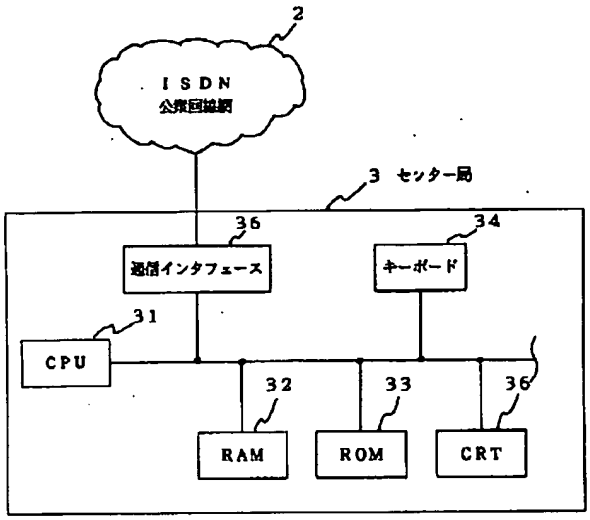
[Drawing 2]


2
ISDN公衆回線網
14
回線インタフェース部
20
TDMA デコード部
18
CPU
21
TDMA エンコード部
13
受信合成部
15 送信部
151 変調回路
152 送信回路
12a 受信部
122 復調回路
121 受信回路
12b
12c
12d
16
アンテナ
17
高周波電力増幅部
11
高周波スイッチ
19a
19b
19c
19d

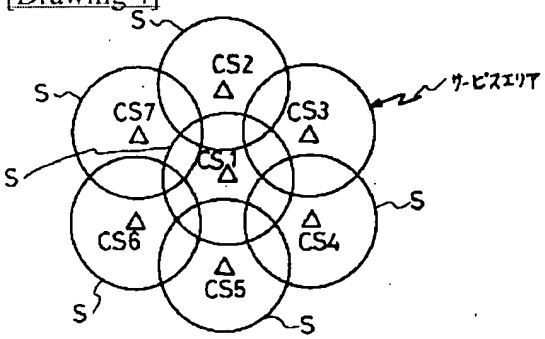
[Drawing 1]


2
ISDN
公衆回線網
3 ユーザ端末
14
回線インタフェース
13
受信合成部
18
CPU
15
送信部
16
ディジタル
17
高周波電力増幅部
11
高周波スイッチ
12a
受信部
12b
受信部
12c
受信部
12d
受信部
1 基地局(CS1)
19a
19b
19c
19d
アンテナ
1
基地局(CS2)
1
基地局(CS3)
4a 移動体端末
4b
4c
4d
4e
4f

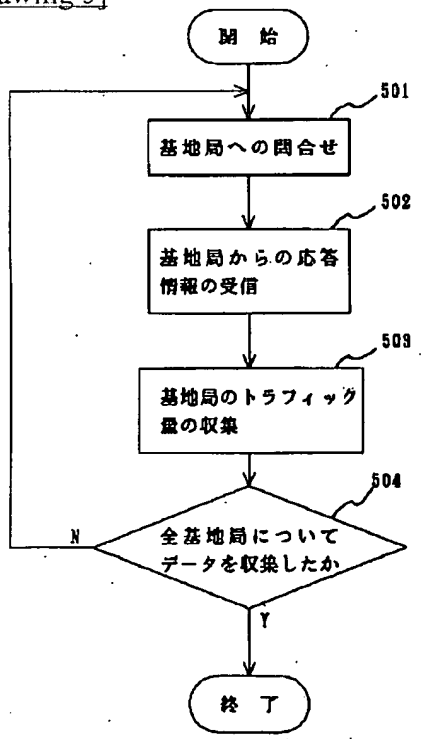
[Drawing 3]



[Drawing 4]



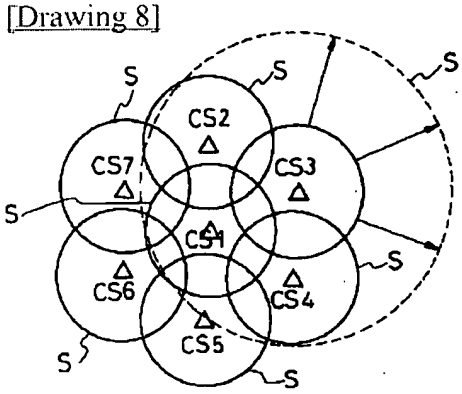
[Drawing 5]



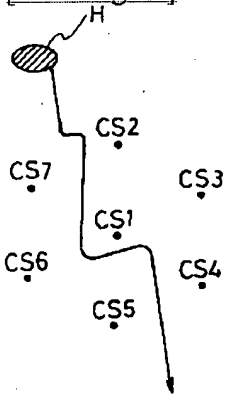
[Drawing 6]

基地局	トラフィック量
CS1	○ ○ ○
CS2	× × ×
CS3	△ △ △
CS4	□ □ □

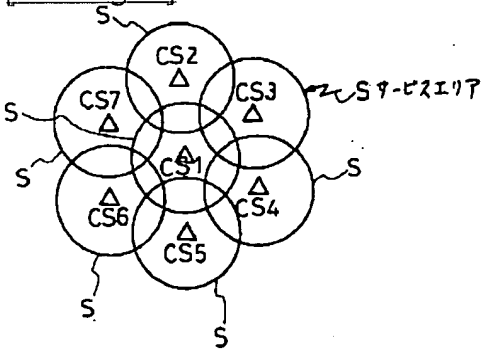
[Drawing 8]



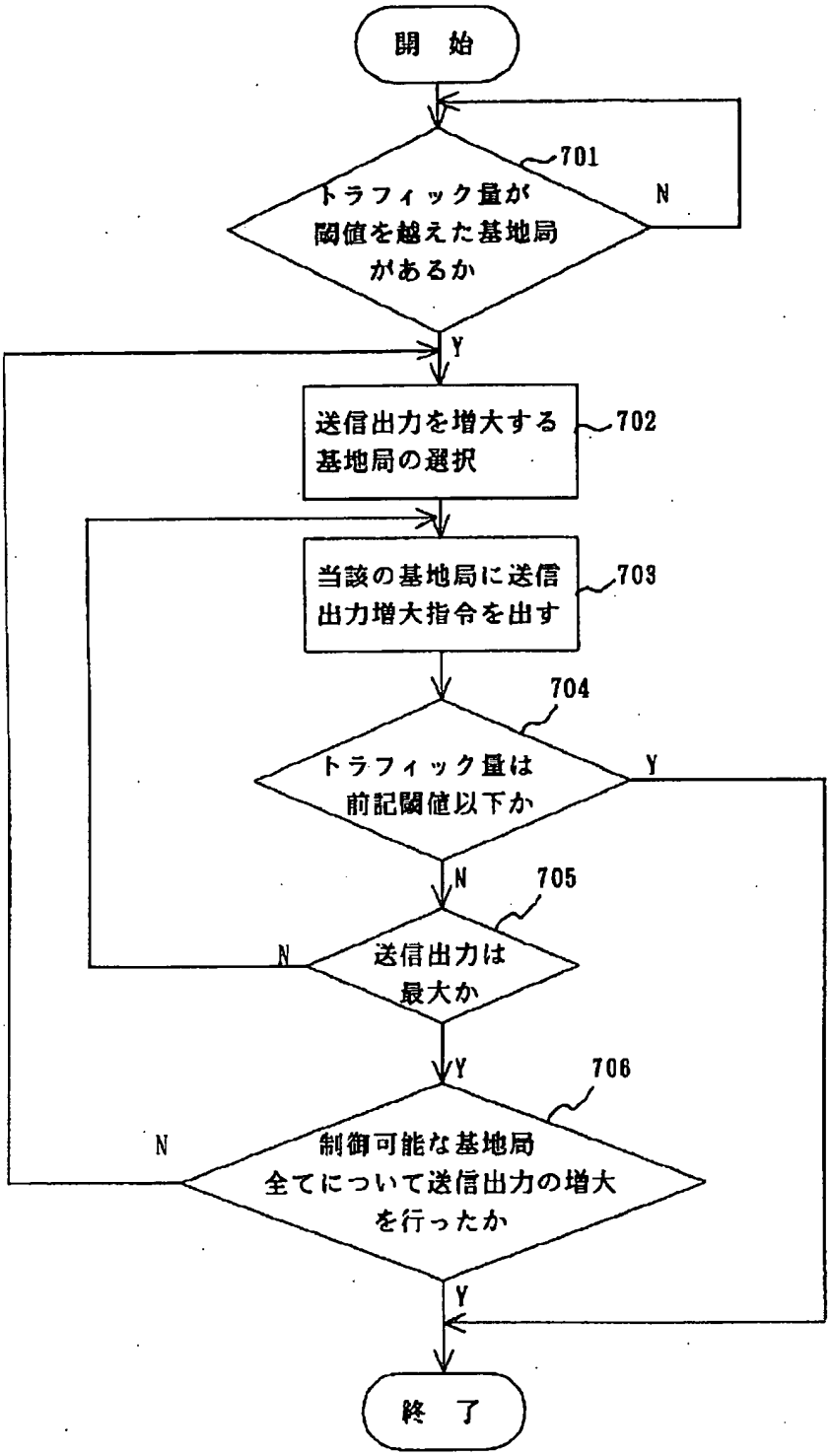
[Drawing 10]



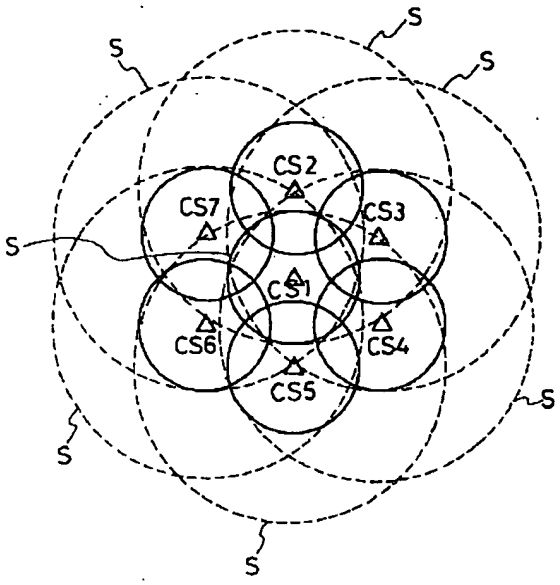
[Drawing 12]



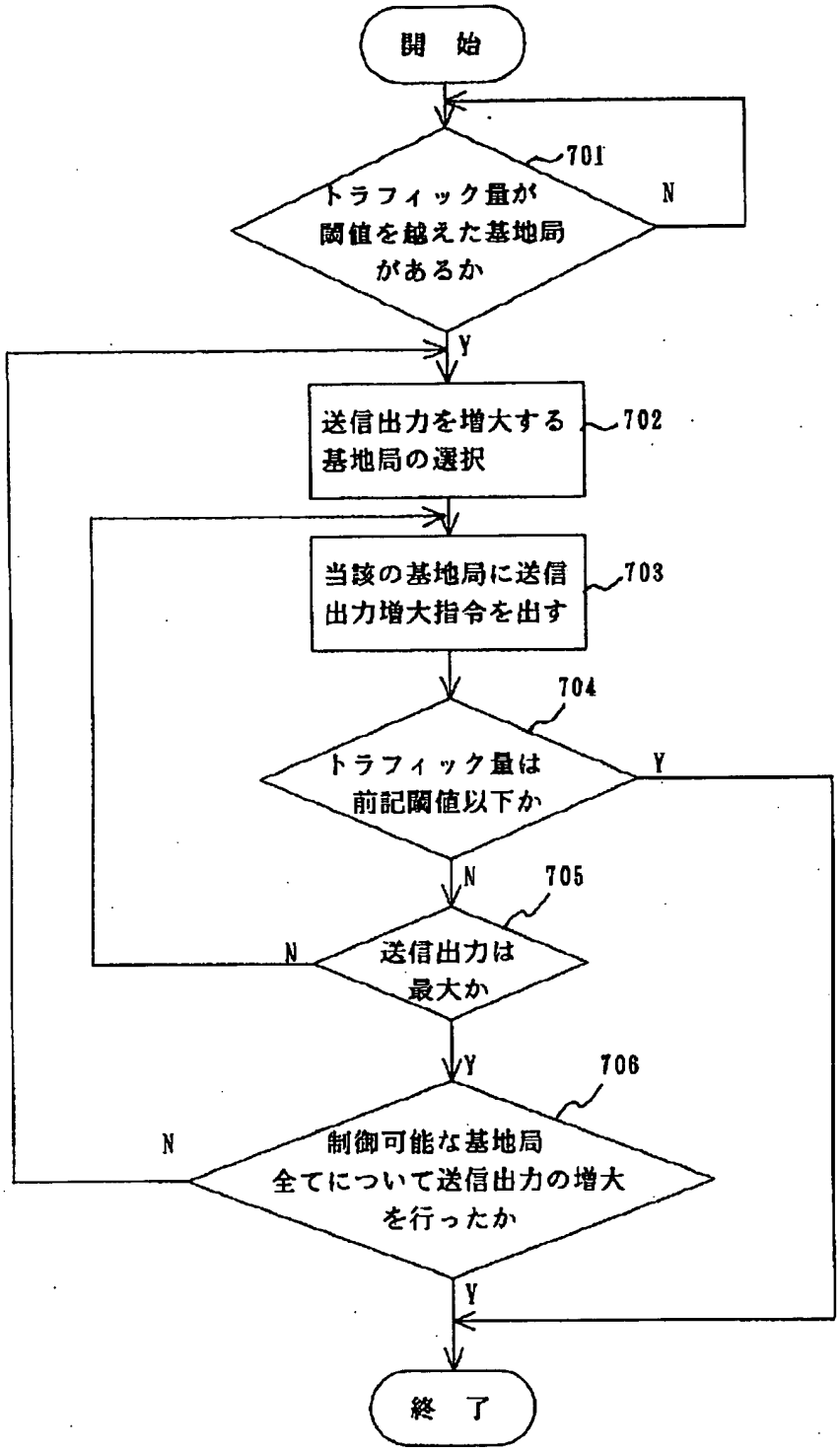
[Drawing 7]


開　始
701
トラフィック量が
閾値を越えた基地局
があるか
N
Y
送信出力を増大する
基地局の選択
702
当該の基地局に送信
出力増大指令を出す
703
704
トラフィック量は
前記閾値以下か
Y
N
705
送信出力は
最大か
N
Y
706
制御可能な基地局
全てについて送信出力の増大
を行ったか
N
Y
終　了

[Drawing 9]



[Drawing 11]



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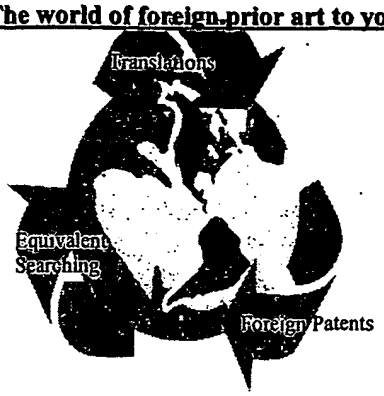

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(71) Applicant: **TOSHIBA CORP**

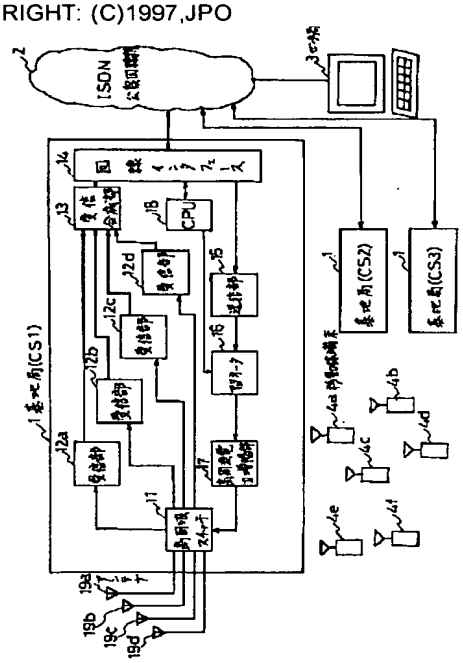
(72) Inventor: **NAKAYAMA SATORU**

(54) MOBILE OBJECT COMMUNICATION SYSTEM

(57) Abstract:

PROBLEM TO BE SOLVED: To improve the efficiency of facilities by eliminating necessity to provide excessive facilities by varying the transmission output of each base station corresponding to the change of traffic quantity.

SOLUTION: A center station 3 cyclically collects the traffic amounts of respective base stations from CPU 18 of respective base stations. When the center station 3 finds out any base station such as CS 2, for example, whose traffic exceeds a threshold, from the collected traffic amounts of respective base stations, a transmission output increasing instruction is outputted to a base station CS 1, for example, for which the traffic amount is least among the base stations around this base station CS 2. The CPU 18 of base station CS 1, that receives this instruction, decreases the attenuation level of attenuator 16, expands its service area by increasing the output level of transmission signal and widens the area overlapped with the service area of base station CS 2 and the base station CS 1 takes charges of one part of communication of mobile object terminal in the service area of base station CS 2. Thus, the traffic of base station CS 2 is reduced less than the threshold and the communication of mobile object terminal is smoothly performed at all times.



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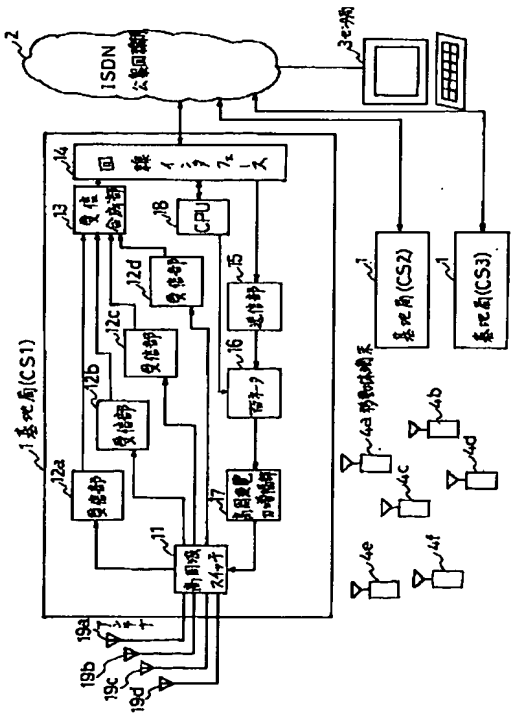
(54)【発明の名称】　移動体通信システム

(57)【要約】

【課題】　各基地局をトラフィック量の変化に対応してその送信出力を可変とすることにより、過剰な設備を持つ必要をなくして設備効率を向上させること。

【解決手段】　センター局３は各基地局のＣＰＵ１８から各基地局のトラフィック量をサイクリックに収集する。センター局３は収集した各基地局のトラフィック量からトラフィックが閾値を越えた例えば基地局ＣＳ２を見付けると、この基地局の周辺の基地局で最もトラフィック量が小さい例えば基地局ＣＳ１にその送信出力増大命令を出す。この命令を受けた基地局ＣＳ１のＣＰＵ１８はアッテネータ１６の減衰レベルを減少させて、送信信号の出力レベルを増大させてそのサービスエリアを拡大し、基地局ＣＳ２のサービスエリアとの重複領域を広げて、基地局ＣＳ２のサービスエリア内の移動体端末の通信の一部を基地局ＣＳ１が受け持つことにより、基地局ＣＳ２のトラフィックを閾値以下に下げて、移動体端末の通信を常に円滑に行う。



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【特許請求の範囲】

【請求項１】　情報の送受信を行う移動体端末と、これら移動体端末相互間或いは、公衆回線網との通信を中継する複数の基地局と、

前記公衆回線網に接続されて前記各基地局の制御を行うセンター局とを有する移動体通信システムにおいて、

前記各基地局に、送信出力レベルを変化可能な送信出力回路と、

この送信出力回路から出力される送信信号レベルの大きさを前記センター局からの指令により制御する出力制御手段とを具備すると共に、

前記センター局に、前記基地局の出力制御手段に前記公衆回線網を通して送信出力可変指令を出すトラフィック制御手段とを具備したことを特徴とする移動体通信システム。

【請求項２】　前記基地局の出力制御手段は前記センター局の前記トラフィック制御手段から出力される送信出力可能指令を受ける毎に予め決められたレベルずつ送信出力回路から出力される送信出力レベルを変化させることを特徴とする請求項１記載の移動体通信システム。

【請求項３】　前記センター局の前記トラフィック制御手段から出力される送信出力可変指令に出力変化レベル情報を含ませ、前記基地局の出力制御手段は前記出力変化レベル情報に応じたレベルに前記送信出力回路から出力される送信出力レベルを変化させることを特徴とする請求項１記載の移動体通信システム。

【請求項４】　前記各基地局に、自局のサービスエリア内の現在のトラフィック量を測定してこれを前記公衆回線網を通して前記センター局に送信するデータ通報手段を設けると共に、

前記センター局に、各基地局の前記データ通報手段から送信されたトラフィック量を受信して基地局毎に収集するデータ収集手段とを設け、

前記センター局のトラフィック制御手段は前記データ収集手段が収集しに基地局毎のトラフィック量に基づいて前記送信出力可変指令を出すことを特徴とする請求項１記載の移動体通信システム。

【請求項５】　前記基地局の通報手段は前記センター局の前記データ収集手段からデータの送信要請を受けた時に前記トラフィック量を前記センター局に送信することを特徴とする請求項３記載の移動体通信システム。

【請求項６】　前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、トラフィック量が閾値を越えた基地局を探し、該当する基地局が見付かると、この基地局の周辺基地局に前記送信出力可変指令の一種である前記送信出力増大指令を出すことを特徴とする請求項４記載の移動体通信システム。

【請求項７】　前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、前記周辺基地局の中で最もトラフィック量が小さい基地局を探し、該当の基地局に前記送信出力増大指令を出すことを特徴とする請求項６記載の移動体通信システム。

【請求項８】　前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、前記周辺基地局の中で最もトラフィック量が小さい基地局を探し、該当の基地局に前記送信出力増大指令を出し、それでも当初トラフィック量が閾値を越えた前記基地局のトラフィック量が閾値以下にならない場合は前記周辺基地局の中で２番目にトラフィック量が小さい基地局に前記送信増大指令を出し、以降、当初トラフィック量が閾値を越えた前記基地局のトラフィック量が閾値以下になるまで、前記周辺基地局の中でトラフィック量が小さい順番に前記送信出力増大指令をこれら基地局に順次出すことを特徴とする請求項６記載の移動体通信システム。

【請求項９】　前記トラフィック制御手段は前記送信出力増大指令を出している基地局の送信出力が最大になると、次の基地局に前記送信出力増大指令を出すことを特徴とする請求項８記載の移動体通信システム。

【請求項１０】　前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、当初トラフィック量が閾値を越えた前記基地局のトラフィック量及び送信出力を増大させた基地局のトラフィック量の大きさを求め、この大きさによって送信出力を増大させた基地局に前記送信出力可変指令の一種である前記送信出力減少指令を出すことを特徴とする請求項６乃至９いずれかに記載の移動体通信システム。

【請求項１１】　前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、当初トラフィック量が閾値を越えた前記基地局のトラフィック量及び送信出力を増大させた基地局のトラフィック量の平均を求め、この平均が所定値以下になると、送信出力を増大させた基地局に前記送信出力可変指令の一種である前記送信出力減少指令を出すことを特徴とする請求項６乃至９いずれかに記載の移動体通信システム。

【請求項１２】　前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、当初トラフィック量が閾値を越えた前記基地局のトラフィック量及び送信出力を増大させた基地局のトラフィック量を求め、これらトラフィック量に各種統計処理を施して得た結果によって送信出力を増大させた基地局に前記送信出力可変指令の一種である前記送信出力減少指令を出すことを特徴とする請求項６乃至９いずれかに記載の移動体通信システム。

【請求項１３】　前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、前記送信出力を増大させた基地局の中で最もトラ

フィック量が小さい基地局に前記送信出力減少指令を出し、それでも前記トラフィック量の平均が所定値以下にならない場合は前記送信出力を増大させた基地局の中で２番目にトラフィック量が小さい基地局に前記送信出力減少指令を出し、以降、前記トラフィック量の平均が所定値以下になるまで、前記送信出力を増大させた基地局の中でトラフィック量が小さい順番に前記送信出力減少指令をこれら基地局に順次出すことを特徴とする請求項１０記載の移動体通信システム。

【請求項１４】　前記トラフィック制御手段は前記送信出力減少指令を出している基地局の送信出力が最小になると、次の基地局に前記送信出力減少指令を出すことを特徴とする請求項１３記載の移動体通信システム。

【請求項１５】　前記基地局に、複数の受信系と、これら受信系による受信信号を合成する受信合成部とを備え、

この受信合成部の合成受信信号を最終的な受信信号とすることを特徴とする請求項１記載の移動体通信システム。

【請求項１６】　前記各受信系は、アンテナと受信部とから成り、

１つの受信系のアンテナを送信用のアンテナと兼用することを特徴とする請求項１５記載の移動体通信システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は携帯電話機等の移動体端末の通信を基地局を介して行う移動体通信システムに係わり、特に基地局の送信出力を可変する構成に関する。

【０００２】

【従来の技術】従来から移動体通信システムにおいては、各基地局ＣＳ１～ＣＳ７のサービスエリアＳの大きさは、例えば図１２のように固定されている。従って、トラフィック量が多いことが想定されるサービスエリアＳにおいては、想定される程度のトラフィック量に対応できる様に無線回線の数を増やすが、基地局を密に配置することにより対応していた。

【０００３】しかしながら、トラフィック量は場所によって変化すると共に時々刻々変化するため、トラフィック量がどの様に変化するかを予め予想することが困難である。従って、トラフィック量が急激に変化すると、通話に割り当てるべき空きの無線チャネルがなくなり、通話ができなくなることがあった。従って、基地局の設置場所や数等を前記トラフィック量がかなり大きくなっても対応できるように余裕を持って設定しなければならないため、設置や運用費がかさみ、特にトラフィック量が小さい時には設備が過剰になって、設備効率が悪化するため、効率のよい通信システムを構築することが難しかった。

【０００４】

【発明が解決しようとする課題】上記のような従来の移動体通信システムでは、時々刻々変化するトラフィック量に対応するため、基地局の設置場所や数等を前記トラフィック量がかなり大きくなっても対応できるように余裕を持って設定しなければならないため、設置や運用費がかさみ、特にトラフィック量が小さい時には設備が過剰になって設備効率が悪化するため、効率のよい通信システムを構築することが難しかった。

【０００５】そこで本発明は上記のような課題を解決するためになされたもので、急激なトラフィック量の変化に対応できるようにし、かつ過剰な設備を持つ必要をなくして設備効率を向上させることができる移動体通信システムを提供することを目的としている。

【０００６】

【課題を解決するための手段】請求項１の発明は、情報の送受信を行う移動体端末と、これら移動体端末相互間或いは、公衆回線網との通信を中継する複数の基地局と、前記公衆回線網に接続されて前記各基地局の制御を行うセンター局とを有する移動体通信システムにおいて、前記各基地局に、送信出力レベルを変化可能な送信出力回路と、この送信出力回路から出力される送信信号レベルの大きさを前記センター局からの指令により制御する出力制御手段とを具備すると共に、前記センター局に、前記基地局の出力制御手段に前記公衆回線網を通して送信出力可変指令を出すトラフィック制御手段とを具備した構成を備えている。

【０００７】請求項２の発明は、前記基地局の出力制御手段は前記センター局の前記トラフィック制御手段から出力される送信出力可能指令を受ける毎に予め決められたレベルずつ送信出力回路から出力される送信出力レベルを変化させる構成を備えている。

【０００８】請求項３の発明は、前記センター局の前記トラフィック制御手段から出力される送信出力可変指令に出力可変レベル情報を含ませ、前記基地局の出力制御手段は前記出力可変レベル情報に応じたレベルに前記送信出力回路から出力される送信出力レベルを変化させる構成を備えている。

【０００９】請求項４の発明は、前記各基地局に、自局のサービスエリア内の現在のトラフィック量を測定してこれを前記公衆回線網を通して前記センター局に送信するデータ通報手段を設けると共に、前記センター局に、各基地局の前記データ通報手段から送信されたトラフィック量を受信して基地局毎に収集するデータ収集手段とを設け、前記センター局のトラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて前記送信出力可変指令を出す構成を備えている。

【００１０】請求項５の発明は、前記基地局の通報手段は前記センター局の前記データ収集手段からデータの送

信要請を受けた時に前記トラフィック量を前記センター局に送信する構成を備えている。

【００１１】請求項６の発明は、前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、トラフィック量が閾値を越えた基地局を探し、該当する基地局が見付かると、この基地局の周辺基地局に前記送信出力可変指令の一種である前記送信出力増大指令を出す構成を備えている。

【００１２】請求項７の発明は、前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、前記周辺基地局の中で最もトラフィック量が小さい基地局を探し、該当の基地局に前記送信出力増大指令を出す構成を備えている。

【００１３】請求項８の発明は、前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、前記周辺基地局の中で最もトラフィック量が小さい基地局を探し、該当の基地局に前記送信出力増大指令を出し、それでも当初トラフィック量が閾値を越えた前記基地局のトラフィック量が閾値以下にならない場合は前記周辺基地局の中で２番目にトラフィック量が小さい基地局に前記送信増大指令を出し、以降、当初トラフィック量が閾値を越えた前記基地局のトラフィック量が閾値以下になるまで、前記周辺基地局の中でトラフィック量が小さい順番に前記送信出力増大指令をこれら基地局に順次出す構成を備えている。

【００１４】請求項９の発明は、前記トラフィック制御手段は前記送信出力増大指令を出している基地局の送信出力が最大になると、次の基地局に前記送信出力増大指令を出す構成を備えている。

【００１５】請求項１０の発明は、前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、当初トラフィック量が閾値を越えた前記基地局のトラフィック量及び送信出力を増大させた基地局のトラフィック量の大きさを求め、この大きさによって送信出力を増大させた基地局に前記送信出力可変指令の一種である前記送信出力減少指令を出す構成を備えている。

【００１６】請求項１１の発明は、前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、当初トラフィック量が閾値を越えた前記基地局のトラフィック量及び送信出力を増大させた基地局のトラフィック量の平均を求め、この平均が所定値以下になると、送信出力を増大させた基地局に前記送信出力可変指令の一種である前記送信出力減少指令を出す構成を備えている。

【００１７】請求項１２の発明は、前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、当初トラフィック量が閾値を越えた前記基地局のトラフィック量及び送信出力を増大させた基地局のトラフィック量を求め、これらトラフィック量に各種統計処理を施して得た結果によって送信出力を増大させた基地局に前記送信出力可変指令の一種である前記送信出力減少指令を出す構成を備えている。

【００１８】請求項１３の発明は、前記トラフィック制御手段は前記データ収集手段が収集した基地局毎のトラフィック量に基づいて、前記送信出力を増大させた基地局の中で最もトラフィック量が小さい基地局に前記送信出力減少指令を出し、それでも前記トラフィック量の平均が所定値以下にならない場合は前記送信出力を増大させた基地局の中で２番目にトラフィック量が小さい基地局に前記送信出力減少指令を出し、以降、前記トラフィック量の平均が所定値以下になるまで、前記送信出力を増大させた基地局の中でトラフィック量が小さい順番に前記送信出力減少指令をこれら基地局に順次出す構成を備えている。

【００１９】請求項１４の発明は、前記トラフィック制御手段は前記送信出力減少指令を出している基地局の送信出力が最小になると、次の基地局に前記送信出力減少指令を出す構成を備えている。

【００２０】請求項１５の発明は、前記基地局に、複数の受信系と、これら受信系による受信信号を合成する受信合成部とを備え、この受信合成部の合成受信信号を最終的な受信信号とする構成を備えている。

【００２１】請求項１６の発明は、前記各受信系は、アンテナと受信部とから成り、１つの受信系のアンテナを送信用のアンテナと兼用する構成を備えている。

【００２２】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照して説明する。図１は本発明の移動体通信システムの一実施の形態の構成を示したもので、本発明を簡易型携帯電話システム（ＰＨＳ）に適用した場合（ＣＳ１，ＳＣ２，ＣＳ３…）のブロック図である。１はＩＳＤＮ公衆回線網２に接続され、当該基地局のエリア内に存在する移動端末４ａ～４ｆとの間で無線回線の設定を行って通信を行う基地局、２はＩＳＤＮ公衆回線網、３はＩＳＤＮ公衆回線網２に接続され、基地局１の送信出力や各種動作の制御や設定を含む当該移動体通信システムの各制御を行うセンター局で、例えばワークステーションとこのワークステーションをＩＳＤＮ公衆回線網２に接続する通信インタフェース部から成っている。４ａ～４ｆは携帯電話機などの移動体端末である。尚、基地局ＣＳ２、ＣＳ３は基地局ＣＳ１と同一構成を有している。

【００２３】ここで、基地局１は、移動局からの送信信号をスペースダイバーシチ方式により確実に受信できるようにするため、それぞれ所定の間隔をもたせて設置されるアンテナ１９ａ～１９ｄ、アンテナ１９ａ～１９ｄで受信した信号を受信部１２ａ～１２ｄ側、又は送信用高周波電力増幅部１７から入力される信号をアンテナ１９ａ～１９ｄのいずれかに切り替える高周波スイッチ部

１１、それぞれのアンテナ１９ａ～１９ｄで捕捉された移動体端末４ａ～４ｆからの送信信号を受信する受信部１２ａ～１２ｄ、受信部１２ａ～１２ｄの受信信号を合成する受信合成部１３、ＩＳＤＮ公衆回線網２と本基地局を接続する回線インタフェース部１４、回線インタフェース部１４からの信号で変調された搬送高周波信号を出力する送信部１５、送信部１５から出力される搬送高周波信号のレベルを調整するアッテネータ１６、アッテネータ１６から入力される搬送高周波信号を電力増幅する高周波電力増幅部１７、アッテネータ１６の減衰レベルを調整したり、或いは本基地局のトラフィック量を把握してセンター局に知らせる等の処理の他基地局全体の各制御を行うＣＰＵ１８を有している。

【００２４】図２は上記した基地局の詳細構成例を示したブロック図である。受信部１２ａ～１２ｄは携帯電話機からの送信信号を受信する受信回路１２１と、この受信回路１２１の受信信号を復調する復調回路１２２を有している。また、受信合成部１３と回線インタフェース１４との間にはＴＤＭＡデコード部２０が設けられ、受信合成部１３で合成されたＴＤＭＡ方式により時分割多重されている復調信号を各スロット毎の信号を分離してから回線インタフェース部１４を介してＩＳＤＮ公衆回線網に出力する。更に、回線インタフェース部１４と送信部１５との間にはＴＤＭＡエンコード部２１が設けられ、回線インタフェース部１４から入力された複数の信号を時分割多重してＴＤＭＡ符号化して、送信部１５に出力している。送信部１５はＴＤＭＡ符号化された信号を変調する変調回路１５１と、この変調回路１５１で変調された変調信号を送信信号とする送信回路１５２を有している。

【００２５】図３は図１に示したセンター局３の詳細構成例を示したブロック図である。３１は本センター局を制御すると共に基地局の送信出力を制御する等の各種処理を行うＣＰＵ、３２はＣＰＵ３１が動作する上で必要な各種データを格納するＲＡＭ、３３はＣＰＵ３１を制御するプログラム等を格納するＲＯＭ、３４はオペレータにより各種指令等がキー入力されるキーボード、３５は各情報を表示するＣＲＴ、３６はＩＳＤＮ公衆回線網２に対して各種情報の送受信を行う通信インタフェースである。尚、ＣＰＵ３１、ＲＡＭ３２、ＲＯＭ３３、キーボード３４、ＣＲＴ３５等は例えばワークステーション等の一部であっても良い。

【００２６】図４は図１及び図２に示した構成を有する各基地局の配置と各基地局が受け持つ通常時のサービスエリアＳの範囲を示した図である。この例では、７個の基地局ＣＳ１～ＣＳ７が図のように６角形の頂点と、その中心点に配置されている。また、基地局ＣＳ１～ＣＳ７のサービスエリアＳはそれぞれの基地局を中心に円形状に広がっており、それぞれのサービスエリアＳの一部が重なるように配置されている。これら７個のサービスエリアＳの中の移動端末は、現在の場所がサービスエリアとなっている基地局との間で無線回線を設定して通話が行えるようになっている。

【００２７】次に本実施の形態の動作について説明する。センター局３は各基地局（ＣＳ１、ＣＳ２、ＣＳ３…）のトラフィック量を把握するため、サイクリックに図５に示すようなフローチャートに従ったトラフィックデータ収集処理を行う。ここでデータ収集処理の対象となるトラフィック量は、データ収集処理時に使用している回線数のデータでもよく、また前回のデータ収集時以降に回線が使用されるので時間を積算したものでもよい。即ち、センター局３のＣＰＵ３１はステップ５０１にて該当の基地局にトラフィックデータの送信指令をＩＳＤＮ公衆回線網２を介して送出する。この指令を受けて、該当の基地局のＣＰＵ１８が自局の現在のトラフィック量を回線インタフェース部１４からＩＳＤＮ公衆回線網２を介してセンター局３に送る。但し、センター局３と基地局間のトラフィックデータの送受の手順には各種方式があり、センター局からは送信指令を行わず、各基地局が所定時間毎に自動的にトラフィックデータを送信するようにしてもよい。

【００２８】これにより、センター局３のＣＰＵ３１はステップ５０２にて前記基地局から送られてきたトラフィック量を受信し、得られたトラフィック量をＲＡＭ３２に設定してある図６に示すような管理表に記憶する。その後、ＣＰＵ３１はステップ５０４にて、全ての基地局ＣＳ１～ＣＳ７からトラフィック量を収集したか判断し、収集していない場合はステップ５０１に戻って、次の基地局に対して上記処理を行い、全ての基地局ＣＳ１～ＣＳ７からトラフィック量を収集した場合は処理を終了する。

【００２９】図６は上記したようにセンター局３で収集された基地局ＣＳ１～ＣＳ７のトラフィック量を収集したデータ表で、各基地ＣＳ１～ＣＳ７毎の現在のトラフィック量が一覧記憶されている。このトラフィック量はセンター局３が図５に示した処理を行う毎に更新されることになる。

【００３０】ところで、移動体通信システムを構成する各基地局ＣＳ１～ＣＳ７の送信出力が通常状態の時、各基地局ＣＳ１～ＣＳ７のサービスエリアＳは図４に示したようになる。しかし、図１０に示すように前記移動体通信システムの高トラフィックの場所Ｈは時々刻々変化して移動するが、その際にある基地局のトラフィック量が増大し、その基地局のサービスエリアでの電話が掛かりにくくなることがある。本例はこのような事態を事前に回避するために、センター局３によってトラフィック量が増大した基地局のトラフィック量を軽減して移動体通信が常に円滑に行われるようにするため、周辺基地局の送信出力増大処理が行われるが、以下この処理について図７のフローチャートに従って説明する。

【００３１】センター局３のＣＰＵ３１はステップ７０１にてトラフィック量が閾値を越えた基地局があるかどうかを図６に示したデータ表をサーチし、該当の基地局があった場合はステップ７０２に進む。ＣＰＵ３１はステップ７０２にて閾値を越えた基地局の周辺の基地局で最もトラフィック量が小さい基地局を前記データ表から探し、この基地局の送信出力を増大することに決めた後、この基地局にステップ７０３にてＩＳＤＮ公衆回線網２を介して送信出力増大指令を出す。

【００３２】ここで、閾値を越えた基地局が図８の基地局ＣＳ１であり、その周辺の基地局で最もトラフィック量が小さい基地局が図８の基地局ＣＳ３であった場合、センター局３は基地局ＣＳ３に上記した送信出力増大指令を出すことになる。

【００３３】前記送信出力増大指令を受けた基地局ＣＳ３のＣＰＵ１８はこの指令を回線インタフェース部１４から受けとると、この増大指令中に含まれている増大レベル情報に応じてアッテネータ１６の減衰レベルを小さくすることにより、高周波電力増幅部１７に入力される搬送高周波信号のレベルを大きくしてアンテナ１９ｄから送信される電波の出力を増大させる。これにより、基地局ＣＳ３のサービスエリアＳが前記送信出力が増大した分だけ広がり、基地局ＣＳ１のサービスエリアＳと重複する範囲が広がって、この分、基地局ＣＳ１で中継していた通信の一部を基地局ＣＳ３が受け持つことができ、その結果として、基地局ＣＳ１のトラフィック量を減少させることができる。

【００３４】次にＣＰＵ３１はステップ７０４にて図６に示したデータ表を再度チェックしてステップ７０１でサーチしたトラフィック量が閾値を越えた基地局ＣＳ１のトラフィック量が前記閾値以下に下がっているかを判定し、下がっている場合は処理を終了し、下がっていない場合ステップ７０５に進んで、現在送信出力を増大させている基地局ＣＳ３の送信出力が最大であるかどうかを判定し、最大でなければ、ステップ７０３に戻って、この基地局ＣＳ３の送信出力を更に増大させる処理を行う。

【００３５】ステップ７０３にて、前記基地局ＣＳ３の送信出力が最大であると判定した場合は、ステップ７０６に進み、既に送信出力の増大を行った基地局ＣＳ３以外で、送信出力の増大が可能な基地局があるかどうかを判定し、ある場合はステップ７０２に戻って、再び図６に示したデータ表をチェックして、残りの送信出力の増大が可能な基地局の中で最もトラフィック量が小さい基地局を探して、この基地局を次の送信出力増大対象基地局に決定して、ステップ７０３以下の処理に進む。しかし、ステップ７０６にて送信出力の増大が可能な基地局がなかった場合は処理を終了する。

【００３６】ここで、上記のようにトラフィックが閾値を越えてた基地局がＣＳ１であって、送信出力を増大させた基地局がＣＳ３であった場合で、この基地局ＣＳ３の送信出力を最大にした段階で、基地局ＣＳ１のトラフィックが閾値以下になった場合、基地局ＣＳ１～ＣＳ７のサービスエリアＳは図８に示した如くなり、基地局ＣＳ３のサービスエリアＳは基地局ＣＳ１の全サービスエリアＳと重複し、基地局ＣＳ３は基地局ＣＳ１のサービスエリアＳ内のかなりの数の移動体端末の通信の中継を行って、基地局ＣＳ１のトラフィック量を減らすことができる。勿論、基地局ＣＳ３のトラフィック量は基地局ＣＳ１のトラフィック量が減った分、増大することになる。

【００３７】次に図１に示した基地局（ＣＳ１，ＣＳ２，ＣＳ３…）の送受信動作について説明する。基地局と移動局間で送受信される信号はＴＤＡＭＡ－ＴＤＤ方式により時間的に４ｃｈ分が時分割多重されて、さらに、送信信号と受信信号が時分割多重されている。高周波スイツチ１１はＣＰＵ１８によって送信時には高周波電力増幅部１７側に切り替わって、高周波電力増幅部１７の出力側と例えばアンテナ１９ｄとを接続し、このアンテナ１９ｄから送信信号が電波として放射される。この時、アッテネータ１６の減衰レベルがＣＰＵ１８により制御されて、送信部１５から高周波電力増幅部１７に入力される送信信号のレベルが調整されて、高周波電力増幅部１７から出力される送信出力が制御され、これらの基地局（ＣＳ１，ＣＳ２，ＣＳ３…）のサービスエリアＳの範囲を変化させることができる。但し、アッテネータ１６の減衰レベルが最大の時、高周波電力増幅部１７から出力される送信電力が通常出力レベルになるように設定してある。

【００３８】一方、受信時、高周波スイツチ１１はＣＰＵ１８によって受信部１２ａ、１２ｂ、１２ｃ、１２ｄ側に切り替わって、例えば受信部１２ａをアンテナ１９ａ、受信部１２ｂをアンテナ１９ｂに、受信部１２ｃをアンテナ１９ｃに、受信部１２ｄをアンテナ１９ｄに接続する。従って、受信部１２ａ、１２ｂ、１２ｃ、１２ｄはアンテナ１９ａ、１９ｂ、１９ｃ、１９ｄが捕捉した移動体端末４ａ～４ｆから送信された同一の信号を受信し、それを復調した信号を受信合成部１３により一つの信号に合成して、回線インタフェース部１４に出力される。ここで、上記したアンテナ１９ａ、１９ｂ、１９ｃ、１９ｄと受信部１２ａ、１２ｂ、１２ｃ、１２ｄから成る４系統の受信系により、同一の電波を受信して受信信号を受信合成部１３で合成することにより、アンテナ１９ａ、１９ｂ、１９ｃ、１９ｄの指向性や受信信号のＳ／Ｎを改善することができ、送信出力を増大させてサービスエリアＳを拡大した時に、遠方の移動体端末からの信号を十分な品質で受信でき、サービスエリアＳを拡大した時の通信品質を一定の水準以上としている。

【００３９】図９は図７に示した周辺基地局の送信出力増大処理を行った結果の各基地局ＣＳ１～ＣＳ７のサー

ビスエリアＳの範囲を示した他の具体例である。この例では、トラフィックが閾値を越えてた基地局ＣＳ１であって、この周辺にある基地局ＣＳ２～ＣＳ７の送信出力をトラフィックの小さい順に最大出力まで増大させて、基地局ＣＳ１のサービスエリアＳをその周辺にある全ての基地局ＣＳ２～ＣＳ７のサービスエリアＳと重複させて、基地局ＣＳ１のトラフィック量を減らしている。

【００４０】ここで、上記した送信出力の増大対象になった基地局の動作について図１に戻って説明する。ＣＰＵ１８は回線インタフェース部１４を介してセンター局３からの送信出力増大指令を受けると、前記指令に含まれている出力変化レベルに対応する分、アッテネータ１６を制御してその減衰レベルを減少させて、送信部１５から高周波電力増幅部１７に入力される搬送波高周波信号のレベルを増大させて、アンテナ１９ｄから送信する送信信号の出力を増大させる。このような制御はＣＰＵ１８がセンター局３から送信出力増大指令を受ける度に行われ、最終的にアッテネータ１６の減衰レベルがゼロになるまで行われ、この段階で、この基地局の送信出力は最大になる。

【００４１】尚、アッテネータ１６の減衰レベルが最大の時の送信出力を通常出力と呼び、この場合の各基地局のサービスエリアＳが図４に示した状態となる。又、上記と異なり、ＣＰＵ１８はセンター局３から送信出力増大指令を受ける度に、予め決められたレベルずつアッテネータ１６の抵抗値を変化させてその減衰レベルを減少させるようにしてもよい。

【００４２】次にセンター局３が基地局の送信出力を増大した後、トラフィック量が減少した場合に前記送信出力の増大した基地局の送信出力を通常出力に戻す処理を行わなければならないが、以下この処理について図１１のフローチャートに従って説明する。

【００４３】センター局３のＣＰＵ３１はステップ１１１にて図６に示したデータ表から当初トラフィック量が閾値を越えた基地局（上記具体例ではＣＳ１）と送信出力を増大させた基地局（図８の具体例ではＣＳ３）のトラフィック量の平均値を求め、この平均値が所定値以下になったかどうかを判定し、所定値以下になった場合はステップ１１２に進む。ＣＰＵ３１はステップ１１２にて送信出力を増大させた基地局で最もトラフィック量が小さい基地局を前記データ表から探し、この基地局の送信出力を減少することに決めた後、この基地局にステップ１１３にてＩＳＤＮ公衆回線網２を介して送信出力減少指令を出す。

【００４４】前記送信出力減少対象となった基地局のＣＰＵ１８はこの指令を回線インタフェース部１４から受けとると、アッテネータ１６の減衰レベルを前記指令で指示された変化レベルを大きくすることにより、高周波電力増幅部１７に入力される搬送高周波信号のレベルを小さくしてアンテナ１９ｄから送信される電波の出力を減少させる。

【００４５】ここで、当初、トラフィック量が閾値を越えた基地局が図８のＣＳ１であり、送信出力の減少対象基地局が図８のＣＳ３であった場合、センター局３は基地局ＣＳ３に上記した送信出力減少指令を出すことになる。これにより、基地局ＣＳ３のサービスエリアＳが前記送信出力が減少した分だけ狭まり、基地局ＣＳ１のサービスエリアと重複する範囲が狭まって、この分、基地局ＣＳ３で中継する通信数が減り、その結果として、基地局ＣＳ１のトラフィック量が増大する。しかし、この場合は既に基地局ＣＳ１とＣＳ２のトラフィック量が減った段階であるため、基地局ＣＳ１のトラフィック量が増えても通信が滞る事態にはならない。

【００４６】次にＣＰＵ３１はステップ１１４にて図６に示したデータ表を再度チェックしてステップ１１１でサーチした基地局のトラフィック量の平均値が前記所定値以上になっているかを判定し、なっている場合は処理を終了し、なっていない場合はステップ１１５に進んで、送信出力を減少させている基地局の送信出力が最小（通常出力）であるかどうかを判定し、最小でなければ、ステップ１１３に戻って、この基地局の送信出力を更に減少させる処理を行う。

【００４７】ステップ１１５にて、前記基地局の送信出力が最小であると判定した場合は、ステップ１１６に進み、まだ送信出力が増大したままの基地局が他にあるかどうかを判定し、ある場合はステップ１１２に戻って、再び図６に示したデータ表をチェックして、送信出力の減少が可能な基地局の中で最もトラフィック量が小さい基地局を探して、この基地局を次の送信出力減少対象基地局に決定して、ステップ１１３以下の処理に進む。しかし、ステップ１１６にて送信出力の減少が可能な基地局がなかった場合は処理を終了する。

【００４８】尚、上記と異なり、ＣＰＵ１８はセンター局３から送信出力減少指令を受ける度に、予め決められたレベルずつアッテネータ１６の抵抗値を変化させてその減衰レベルを増大させるようにしてもよい。又、センター局３のＣＰＵ３１が送信出力の減少処理に入る基準として、図６に示したデータ表から当初トラフィック量が閾値を越えた基地局（上記具体例ではＣＳ１）と送信出力を増大させた基地局（図８の具体例ではＣＳ３）のトラフィック量の大きさを求め、この大きさを拠り所としても良し、或いは当初トラフィック量が閾値を越えた基地局（上記具体例ではＣＳ１）と送信出力を増大させた基地局（図８の具体例ではＣＳ３）のトラフィック量に各種統計処理を施して、その結果を拠り所としても良い。

【００４９】ここで、例えば図８に示すように基地局ＣＳ２～ＣＳ７の送信出力を増大させてサービスエリアＳを拡大した例では、基地局ＣＳ１のトラフィック量が減少して通常の値に戻るにともない、基地局ＣＳ２～ＣＳ

７の送信出力が順次通常値に戻り、最終的には図Ｓに示した通常状態に戻ることになる。

【００５０】本実施の形態によれば、トラフィック量の変化、特にトラフィック量が増大した基地局における移動体端末の通信の滞りを防止するため、周辺の基地局の送信出力を増大させて、前記トラフィック量が増大した基地局のサービスエリアＳを前記周辺の基地局のサービスエリアＳで重複して覆うことにより、前記トラフィック量が増大した基地局のサービスエリアＳ内の移動体端末の通信の一部を前記周辺の基地局で分担することにより、前記トラフィック量が増大した基地局のトラフィック量を減少させて、移動体端末の通信を常に円滑に行うことができる。

【００５１】又、本例はトラフィック量の変化によって、一つの基地局のトラフィック量が増大した場合は周辺の基地局の送信出力を上げてこれら基地局のトラフィック量を増大させて、基地局のトラフィック量を平準化することにより、各基地局の稼働率などを平準化することにより、高トラフィック状態に対応することができるため、過剰な基地局等の設備を持つ必要がないため、設備の設置費や運用費を抑えることができ、効率のよいシステムを構築することができる。

【００５２】更に、トラフィック量が減少してくると、速やかに送信出力を増大させた基地局の送信出力を元の通常値に戻してそのサービスエリアＳを通常範囲にするため、基地局間の干渉を最小限に押さえることができる。又、本例では、基地局の受信系をアンテナを含めて４系統備えているため、送信出力を増大してサービスエリアＳを広げた際に、遠方の移動体端末からの信号をＳ／Ｎ良く高品質で受信できるため、上記のように送信出力を増大してサービスエリアＳを広げた基地局を介した通信の品質を良好に保持することができる。なお、以上説明した実施の形態例として各基地局が公衆回線を介して、センター局と接続されている簡易型携帯電話システムを例をとして説明しているが、もちろん各基地局とセンター局が専用線で接続される一般の携帯電話システムに適用できる。

【００５３】

【発明の効果】以上記述した如く請求項１乃至３いずれかに記載の移動体通信システムによれば、トラフィック量の変化に対応して各基地局の送信出力を可変として、サービスエリアの範囲を変化させることにより、トラフィック量の増大にダイナミックに対応することができる。

【００５４】請求項４又は５記載の移動体通信システムによれば、各基地局のトラフィック量をセンター局に収集することができ、センター局はこの収集データに基づいて各基地局の送信出力を変化させることができる。

【００５５】請求項６又は７記載の移動体通信システムによれば、トラフィック量が大きくなった基地局のトラフィック量を減少させる制御を行って、常に移動体端末の通信を円滑に行うことができる。

【００５６】請求項８又は９記載の移動体通信システムによれば、複数の基地局の送信出力を増大して、トラフィック量が大きくなった基地局のトラフィック量を減少させることにより、移動体端末の通信を常に円滑に行うことができると共に、過剰な設備を持つ必要をなくして設備効率を向上させることができる。

【００５７】請求項１０乃至１４いずれかに記載の移動体通信システムによれば、トラフィック量が減少してくると、速やかに送信出力を増大させた基地局の送信出力を減少させて、基地局間の干渉を最小限に抑えることができる。

【００５８】請求項１５又は１６記載の移動体通信システムによれば、サービスエリアが拡大しても、通信品質を良好に保持することができる。

【図面の簡単な説明】

【図１】本発明の移動体通信システムの一実施の形態の構成を示したブロック図。

【図２】図１に示した基地局の詳細例を示したブロック図。

【図３】図１に示したセンター局の詳細例を示したブロック図。

【図４】図１に示した移動体通信システムの基地局の配置とそのサービスエリアの範囲を示した図。

【図５】図１に示したセンター局の各基地局のトラフィック量を収集する処理を示したフローチャート。

【図６】図３に示したＲＡＭ内に設定されてデータ表の一例を示した図。

【図７】図１に示したセンター局による基地局の送信出力の増大処理を示したフローチャート。

【図８】図１に示した移動体通信システムの基地局の一つの送信出力を増大してそのサービスエリアの範囲を拡大した状態を示した図。

【図９】図１に示した移動体通信システムの複数の送信出力を増大してそのサービスエリアの範囲を拡大した状態を示した図。

【図１０】図１に示した移動体通信システムの中でトラフィック量の増大部分が移動していく状態を示した図。

【図１１】図１に示したセンター局による基地局の送信出力の減少処理を示したフローチャート。

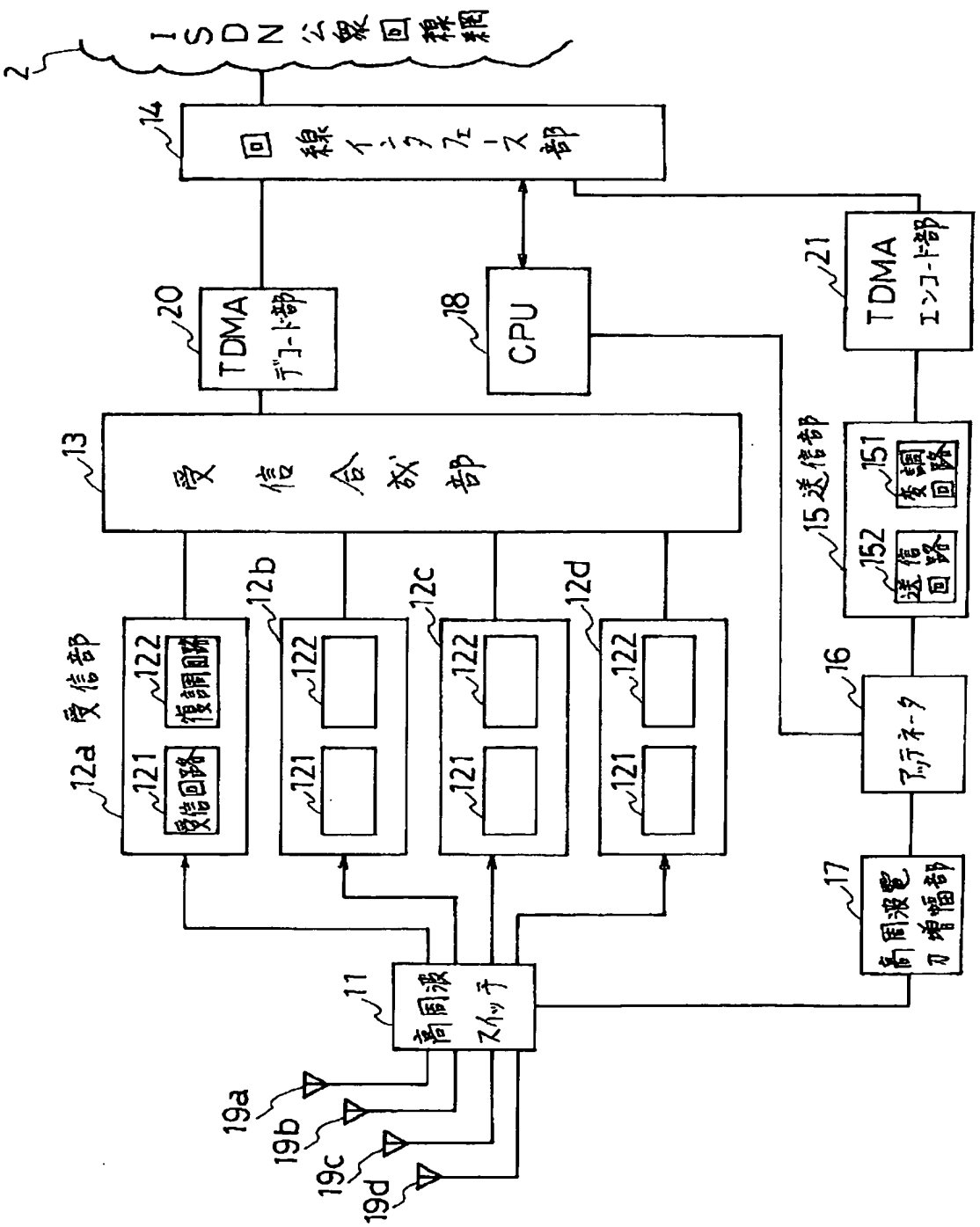
【図１２】従来の移動体通信システムの基地局の配置とそのサービスエリアの範囲を示した図。

【符号の説明】

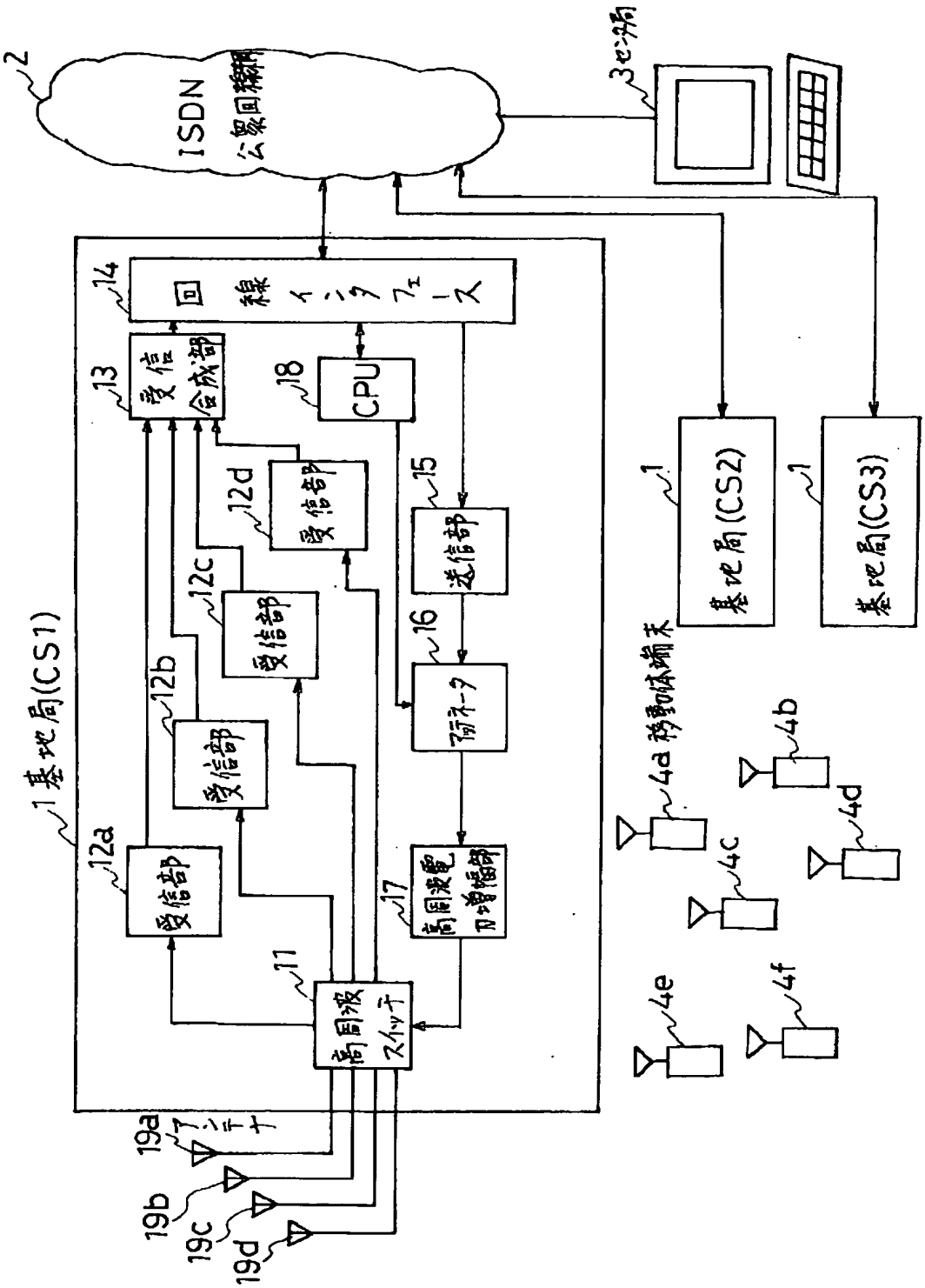
１（ＣＳ１～ＣＳ７）…基地局
２…ＩＳＤＮ公衆回線網
３…センター局
１１…高周波スイッチ
１２ａ～１２ｄ…受信部
１３…受信合成部

１４…回線インタフェース部
１５…送信部
１６…アッテネータ
１７…高周波電力増幅部
１８，３１…ＣＰＵ
１９ａ～１９ｄ…アンテナ
＊３２…ＲＡＭ
３３…ＲＯＭ
３４…キーボード
３５…ＣＲＴ
３６…通信インタフェース
＊

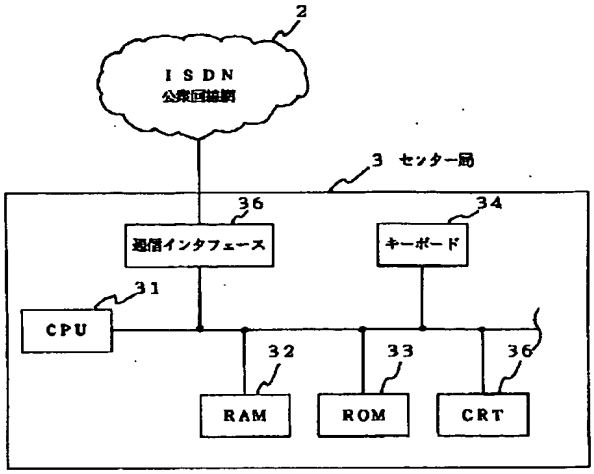
【図２】



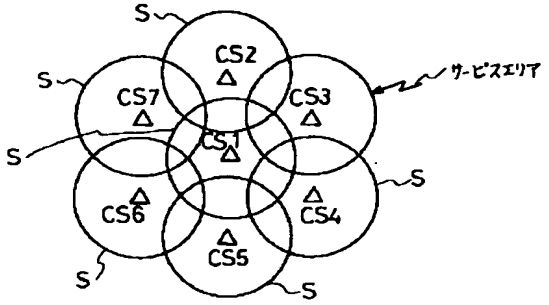
【図1】


2
ISDN
公衆回線網
3 ホスト
1 基地局(CS1)
14 回線インタフェース
13 受信合成部
18 CPU
12a 受信部
12b 受信部
12c 受信部
12d 受信部
15 送信部
16 ルータ
17 高周波電力増幅部
11 高周波スイッチ
19a アンテナ
19b
19c
19d
1 基地局(CS2)
1 基地局(CS3)
4a 移動体端末
4b
4c
4d
4e
4f

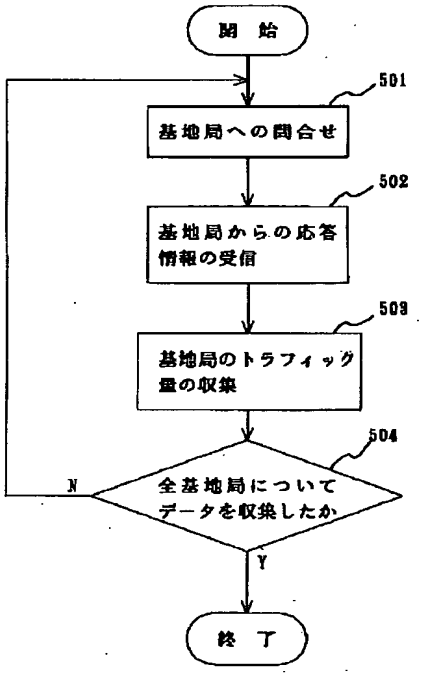
【図３】



【図４】



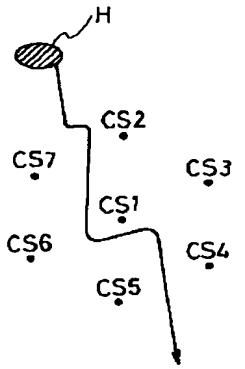
【図５】



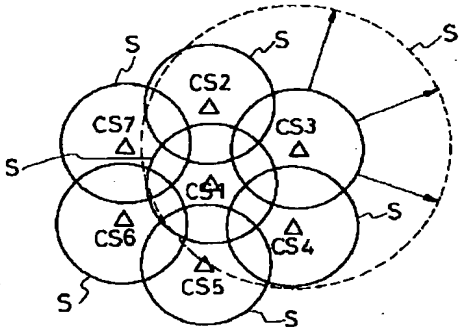
【図６】

基　地　局	トラフィック量
ＣＳ１	○　○　○
ＣＳ２	×　×　×
ＣＳ３	△　△　△
ＣＳ４	□　□　□

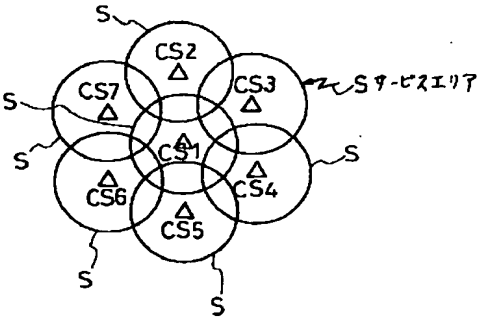
【図１０】



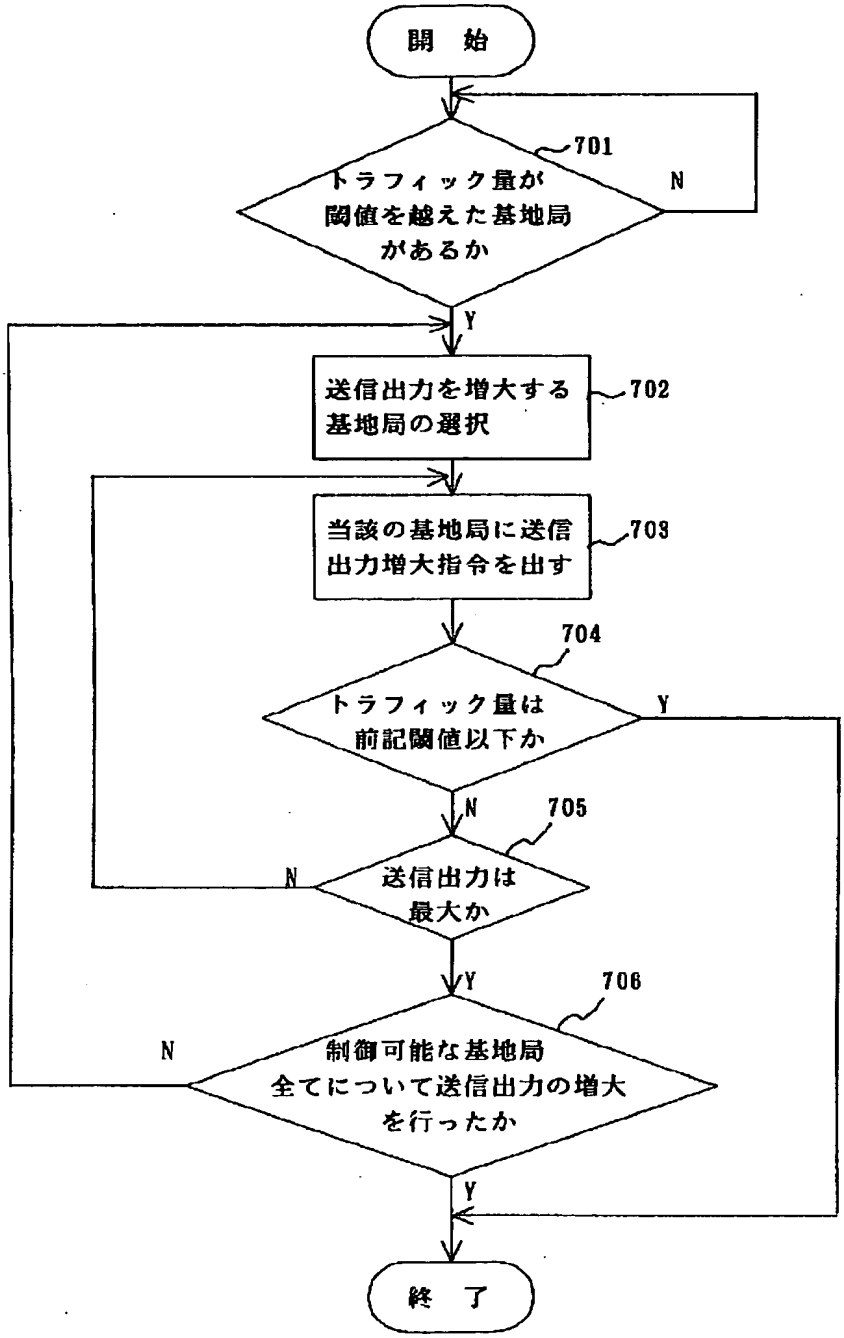
【図８】



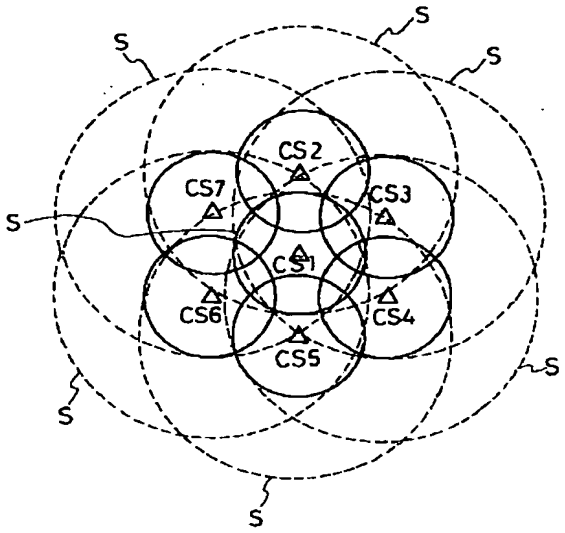
【図１２】



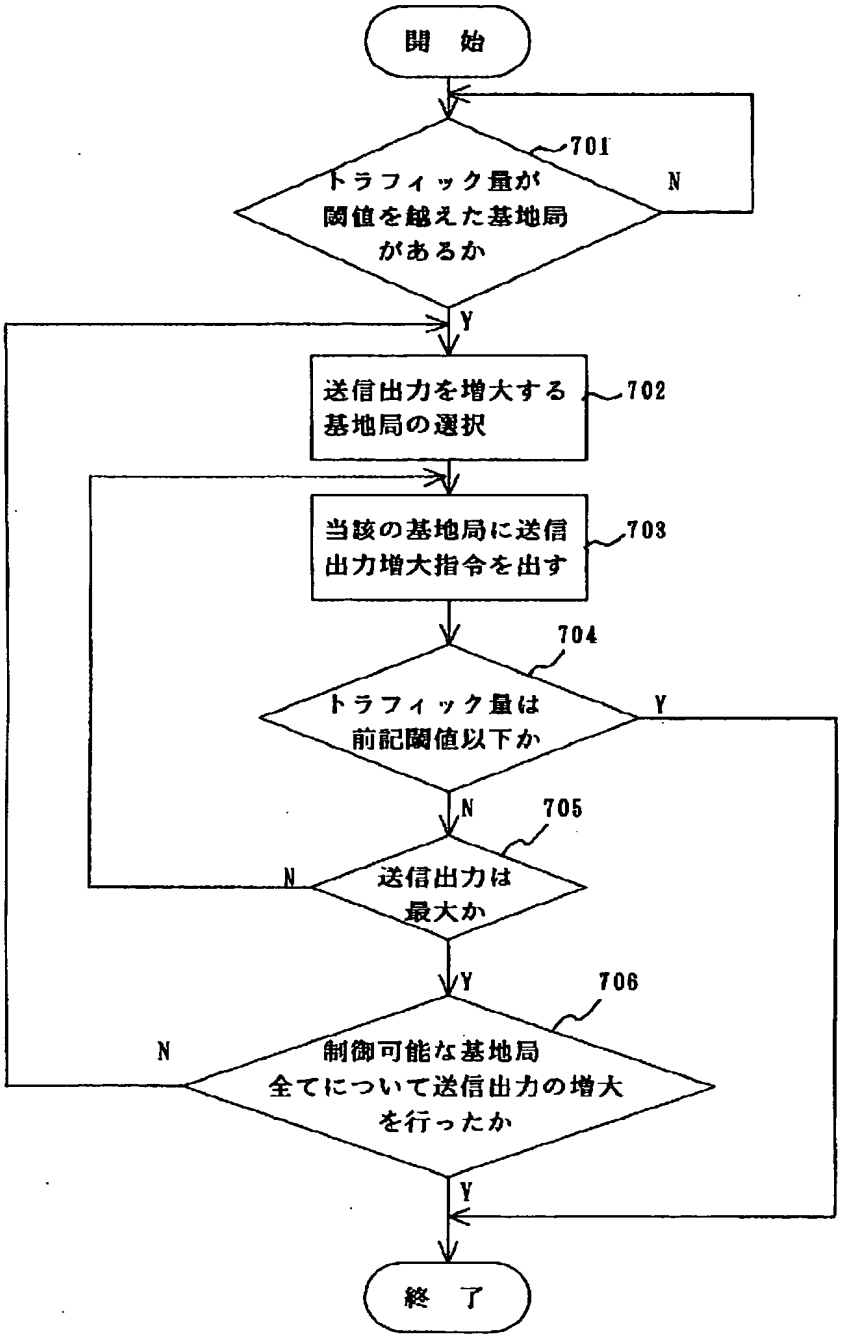
【図７】


開　始
701
トラフィック量が
閾値を越えた基地局
があるか
N
Y
送信出力を増大する
基地局の選択
702
当該の基地局に送信
出力増大指令を出す
703
704
トラフィック量は
前記閾値以下か
Y
N
705
送信出力は
最大か
N
Y
706
制御可能な基地局
全てについて送信出力の増大
を行ったか
N
Y
終　了

【図９】



【図１１】


開　始
701
トラフィック量が
閾値を越えた基地局
があるか
N
Y
送信出力を増大する
基地局の選択
702
当該の基地局に送信
出力増大指令を出す
703
704
トラフィック量は
前記閾値以下か
Y
N
705
送信出力は
最大か
N
Y
706
制御可能な基地局
全てについて送信出力の増大
を行ったか
N
Y
終　了